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IMPERIAL INSTITUTE OF ENTOMOLOGY.

Sir Guy Marshall, K.C.M.G., F.R.S., D.Sc.

and

Dr. Sheffield A. Neave, C.M.G., O.B.E.

Sir Guy Marshall has been Director of the Imperial Institute (formerly Bureau) of Entomology, since it was founded in 1913. He is known personally or by repute to most entomologists in the world. A numerous and widely scattered circle of friends will regret his retirement on 31st July as deeply as do the Executive Council and the Staff of the Institute. He takes with him all their best wishes. His connections with the Institute are not, however, being severed entirely. For the time being he will continue his work on the identification of certain groups of insects and, at the invitation of the Secretary of State for the Colonies, his supervision of the work of the Anti-Locust Research Centre.

He is being succeeded as Director by Dr. S. A. Neave, C.M.G., O.B.E., who has been Assistant Director since 1914 and has been for many years in charge of the *Review of Applied Entomology*. Latterly he has completed and issued the *Nomenclator Zoologicus*—an indispensable book of reference. Many know him personally; many more know the publications for which he has been responsible.

Sir Guy was appointed Scientific Secretary to the Entomological Research Committee (Tropical Africa) on 1st July, 1909. At the same time Dr. S. A. Neave was appointed one of the two entomologists to work in Tropical Africa. "If we are to make our Central African colonies habitable and profitable and healthy, increased attention should be paid to the insect fauna, whether inimical or beneficial, but in the first instance to the former," expressed the purpose of the new Committee. The receipt of specimens sent in by the collectors, their identification, report back on them to the collectors, and the issue of a Bulletin it was hoped might be published, were the chief duties of the Secretary. Applied Entomology was thus the objective; "the judicious encouragement and stimulation of the field workers by correspondence" and the dissemination of information were to be the means, not detailed direction and control of the work of the entomologists in the field.

This small organisation was soon extended. With the active support of Canada, it became in 1913 a truly inter-imperial service maintained by and serving all countries in the British Commonwealth. The *Review of Applied Entomology* surveying regularly all current literature on Economic Entomology, was started. Sir Guy has been in charge throughout, and throughout the methods have remained the same—help, stimulation and dissemination of knowledge and information to the man in the field and to entomological departments; never control or dictation. The service has proved its worth; the bureaux which have come later follow those same principles, proved and tested by the Institute. The service Sir Guy built up has extended far beyond anything he imagined in 1909.

S. LALL,
Chairman,
Executive Council of the Imperial Agricultural Bureaux.

21st July, 1942.

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PRUTHI (H. S.) & MANI (M. S.). **Biological Notes on Indian parasitic Chalcidoidea.**—*Misc. Bull. Coun. agric. Res. India* no. 30, 44 pp., 22 pls., many refs. Delhi, 1940.

This bulletin, which is the first of a series designed to collate information on the parasites of Indian insects and is based on the literature and host records for species in collections in the laboratories of the Imperial Entomologist, comprises a systematic list of nearly 190 Chalcidoids, with references to the original descriptions and records of hosts and in some cases habits, followed by an index of hosts showing which parasites attack them.

JOHNSON (C. G.). **Insect Survival in Relation to the Rate of Water Loss.**—*Biol. Rev.* **17** no. 2 pp. 151–177, 12 figs., 24 refs. Cambridge, 1942.

The following is the author's summary. If the relation between rate of water loss from an insect and saturation deficiency is linear and survival is limited only by water loss, then the curve of longevity against saturation deficiency is hyperbola-shaped. The position of this curve with respect to the co-ordinates is, however, affected by other factors, which are discussed. The work of Bacot & Martin [*R.A.E.*, B **13** 128] on the longevity of the rat flea, *Xenopsylla cheopis*, Roths., is reviewed in the light of the above hypothesis : errors in curve fitting are revealed which make it necessary to modify some of Bacot & Martin's conclusions. Selected data from various authors subsequent to Bacot & Martin are considered. The discrepancies, real and apparent, between Leeson's results with rat fleas [B **20** 180 ; **24** 250] and those of Bacot & Martin are analysed, and it is pointed out that these were to some extent due to errors in curve fitting. The hypothetical relation between longevity, rate of water loss and saturation deficiency set out in the first part of this article is illustrated by Ludwig's data for *Popillia japonica*, Newm. [A **25** 520] ; the linear relationship between 1/longevity and the rate of water loss demonstrates the hypothesis that water loss limits survival with this insect. Other less complete data are also discussed. Various types of longevity-saturation deficiency curves are described and the causes which probably account for such variations. The relationship of pupal or egg mortality to saturation deficiency cannot by itself throw light on the variation of rate of water loss with saturation deficiency ; the time factor must also be taken into account. Lines of equal mortality may coincide with lines of equal saturation deficiency (the co-ordinates being relative humidity and temperature), so that the product of mortality and saturation deficiency is constant at any one temperature ; but this indicates only that temperature is without effect on mortality and does not throw light on the relation of mortality to different saturation deficiencies. Such coincidence of lines cannot, therefore, be taken as proof that Dalton's law operates.

Insect Pests.—*Agric. Gaz. N.S.W.* **52** pt. 9 pp. 484–488, 5 figs., pt. 10 pp. 531–535, 539, 7 figs. Sydney, 1941.

Since regulations in New South Wales provide that all waste fruit or fruit infested with the codling moth [*Cydia pomonella*, L.] or fruit-flies must be treated by boiling, burning or placing in a suitably constructed pit, these two parts of a series on insect pests there [*cf. R.A.E.*, A **30** 280] include recommendations on the construction of such pits, which are in use in many parts of the State. The most important feature is the lid or trap-door, which should be easy to move and must be insect-proof. Emergence of moths or flies within the pits may occur when a small quantity of fruit is first introduced, but is not normally possible in the presence of a large quantity of rotting fruit. In some districts apples placed in the pit do not break down readily, which limits the quantity of fruit that can be disposed of in one pit ;

in such cases some fruit should be crushed and allowed to rot in open containers and this rotting material introduced to start a general decay. As many as 150 fruit-flies have been bred from a single fruit, and the importance of checking an increase in numbers by disposing of waste fruit cannot be over-emphasised.

The second part also includes notes on the life-history and control of the clothes moths, *Tinea pellionella*, L., and *Tineola biselliella*, Humm., and the tapestry moth, *Trichophaga tapetzella*, L., the larvae of which feed on wool, fur, hair, feathers and articles manufactured from them. It is recommended that fabrics exposed to infestation should not be left undisturbed for long periods. Infested carpets and upholstered furniture can be sprayed with a mixture of 4 oz. pyrethrum powder, 1 quart kerosene and ¾ fl. oz. methyl salicylate to kill the larvae, but in cases of heavy infestation, fumigation may be necessary. The use of baits [*cf.* **29** 255] is discussed.

JOHNS (R.). **Annual Report of the Department of Agriculture (British Solomon Islands Protectorate), 1st April 1940–31st March 1941.**—6 pp. multigraph. Tulagi, 1941.

Work on the biological control of *Brontispa longissima*, Gestro (*froggatti*, Sharp), *Axiagastus cambelli*, Dist., and *Amblypelta* [*cocophaga*, China], which are the most important pests of coconut, was continued in the Solomon Islands in 1940–41. Liberations of the introduced parasites, *Tetrastichus* (*Tetrastichodes*) *brontispae*, Ferrière, and *Trichogrammatoidea nana*, Zhnt., against *Brontispa* have been made over a long period, especially in the case of the former, but although both became established effective control has not resulted. The egg-parasite, *Microphanurus basalis*, Woll., was recently introduced against *Axiagastus cambelli* [*R.A.E.*, A **30** 158] and is established. Attempts to find an effective parasite of *Amblypelta cocophaga* [*cf.* **30** 321], which causes immamature nutfall, have not proved successful and the most effective is still the native egg-parasite, *Anastatus axiagasti*, Ferrière; *Ooencyrtus* sp. has been introduced from Java, but the degree of parasitism is in each case insufficient. Attempts to introduce the Tachinid, *Trichopoda pennipes*, F., from Florida *via* Fiji [**29** 496] against *Amblypelta* were unsuccessful.

Many liberations of the insectivorous toad, *Bufo marinus*, which was imported from Fiji, were made against insect pests of gardens, over wide areas. Thrips from a colony of *Liothrips urichi*, Karny, which was introduced from Fiji for the control of the noxious weed, *Clidemia hirta*, were liberated in the Shortlands Island District [*cf.* **29** 495].

COTTRELL-DORMER (W.). **Report of the Director of Agriculture (Tonga) for 1940.**—9 pp., 1 ref. Nukualofa, 1941.

This report includes a list of insects injurious to crops in the Tonga Islands, showing their food-plants and the part attacked. The more injurious are *Nacoleia octasema*, Meyr., and *Cosmopolites sordidus*, Germ., on banana; *Plutella maculipennis*, Curt., on turnip and cabbage; *Crocidolomia binotalis*, Zell., on turnip; *Earias fabia*, Stoll, on cotton; *Euscepes postfasciatus*, Fairm., on kumara [sweet potato]; *Nezara viridula*, L., which was observed on Vavau and Tongatabu and is probably a recent importation, on beans, ground-nuts, and tomatos; and *Dacus* (*Strumeta*) *facialis*, Coq., and *D.* (*S.*) *kirki*, Frogg., on guava and other fruits. Pests of less importance include *Argyroploce illepida*, Btlr., on ifi [? *Inocarpus edulis*]; *Margaronia indica*, Saund., on cucumber; *Aulacophora* sp. on cucumber and pumpkin; *Maruca testulalis*, Geyer, *Leptoglossus australis*, F., *Riptortus insularis*, China, and *Brachyplatys pacificus*, Dall., on leguminous plants; *Tirathaba trichogramma*, Meyr., on coconut; *Plusia chalcites*, Esp., on lettuce and tomato; *Elytrurus* sp. and *Tectocoris diophthalmus*, Thnb. (*lineola*, F.) on cotton; *Rhabdocnemis obscura*, Boisd., and *Perkinsiella vitiensis*, Kirk., on sugar-cane and the latter also on maize;

Austracris guttulosa, Wlk., on ground-nuts and rice; *Dacus* (*Notodacus*) *xanthodes*, Broun, on papaya; and *Necrobia rufipes*, DeG., and *Bradymerus amicorum*, Fairm., on copra. *Teleonemia scrupulosa*, Stål, which was imported from Fiji in 1939 for liberation against *Lantana* [*cf. R.A.E.*, A **28** 380], is present in small numbers in the area in which it was released, but has not checked the weed appreciably.

TALHOUK (Abdul Mon'im S.). **The Insect Fauna supported by the Apple and Pear Trees in Lebanon.**—*Ent. Rec.* **53** no. 12 pp. 125–128. London, 1941.

Brief notes are given on 55 species of insects observed by the author on apple and pear in Lebanon. The greatest amount of damage is caused by Lepidoptera and Homoptera, but the weevil, *Rhynchites splendidus*, Kryn., is sometimes very destructive to young pear fruits. The females oviposit in the fruits and sever the stalks at their point of contact with the spur, causing the fruits to shrivel and drop. Attack is localised, since the females prefer certain varieties for oviposition and neglect others. The Lepidoptera stated to be injurious are *Zeuzera pyrina*, L., *Cydia* (*Carpocapsa*) *pomonella putaminana*, Stgr., which has two generations a year and sometimes a partial third, and, on apple, *Diloba coeruleocephala*, L., and *Argyroploce variegana*, Hb. The Homoptera include *Psylla pyricola*, Forst., which has several generations a year and causes serious injury to pear; *Eriosoma lanigerum*, Hsm., which, unlike its parasite, *Aphelinus mali*, Hald., is not affected by the hot dry desert winds in spring, and attacks apple severely until the parasite becomes abundant in the autumn and keeps it in check; *Aphis pomi*, DeG., which is abundant on the tips of vigorous apple shoots and inside the curled leaves; *Lachnus persicae*, Cholod., which is becoming increasingly abundant on the trunks and branches of apple in spring; *Stephanitis* (*Tingis*) *pyri*, F., which is common on the leaves of both apple and pear, but is controlled by a fungus that attacks it soon after it has become established on the foliage; and *Aspidiotus hederae*, Vall., which is common and injurious on both apple and pear.

RÉGNIER (R.). **Contribution à l'étude de la biologie du hanneton commun** (*Melolontha melolontha* **L.**).—*C. R. Acad. Sci.* **212** no. 6 pp. 246–249. Paris, 1941.

An account is given of the results of observations on *Melolontha melolontha*, L., in Normandy in 1938–40. At the beginning of the flight period, which occurred in 1940 and recurs every 3 years, the males were two or three times as numerous as the females, about 50 per cent. of which were sterile. Oviposition did not begin for about 20 days, and the numbers of eggs deposited were usually small. Many of the males die in the first fortnight, so that collecting the adults then will destroy only a small proportion of the fertilised females. Collecting should be intensified after the peak of the flight, instead of being stopped, as it usually is. In 1940, the first large swarms appeared on 27th April, and maximum numbers were reached on 3rd May; oviposition did not begin until 18th May, and it is considered that collection should have been intensified from 10th May. The nature of the soil influences the development of the larvae, which can migrate 15–20 ins. horizontally or vertically in 24 hours. Pupation occurred nearer the surface in heavy soil than in lighter, well-worked soil. The adults did not necessarily hibernate in the pupal cells, many of which were destroyed in autumn by ploughing. In such cases, the beetles penetrated deeper into the soil and constructed fresh cells, which they did not leave until the average soil temperature exceeded 15°C. [59°F.]. The eggs were usually laid at a depth of 4–6 ins. in groups of 12–15 or more. As they are very susceptible to destruction by direct sunlight before hardening, which requires several days, methods of soil cultivation that bring them to the surface during this period are to be recommended.

KOMÁREK (J.) & KOLUBAJIV (S.). **Einige Beobachtungen über den Kiefernspinner.** [Some Observations on *Dendrolimus pini*, L.]—*Zbl. ges. Forstw.* **67** pt. 11 pp. 245–251, 1 fig., 22 refs. Vienna, 1941.

The observations described were made in the course of an outbreak of *Dendrolimus pini*, L., on pines in the Elbe Valley, Bohemia. Adults were common throughout the area in 1937, and the population increased to outbreak proportions in unmixed stands in 1938 and 1939. The outbreak collapsed in these years in those with a soil covering of grass but continued to increase in 1940 in stands on sandy soil with a light covering of moss. It was terminated in 1941 by a disease that attacked the overwintered larvae. Defoliation of the trees was severe and pines of all ages were attacked. No outbreak occurred in stands in which pine was mixed with oak. The authors consider that early warning of an increase can best be obtained by observing the numbers of adults, which are easily caught. The results of the collections should be checked by using Dyk's method of attracting the males by the scent of the newly emerged females [*R.A.E.*, A **21** 299; **26** 665]. The terminalia of the pupae of both sexes of *D. pini* are figured, since the identification of their sex is a necessary preliminary to breeding the females. If these methods indicate a coming increase, control should be begun in the following spring. Outbreaks can usually be controlled by applying adhesive bands to the trees in spring to prevent the ascent of the overwintered larvae, but a suitable adhesive was not available during the outbreak in question. In laboratory tests, two proprietary dusts (Detal and D.I.) containing dinitro-ortho-cresol gave complete mortality of the larvae in all instars.

Most of the larvae hibernate in the ground under the moss, the smaller individuals being nearer the tree trunk; they were not affected by temperatures of −30°C. [−22°F.], which occurred for several weeks in the winters of 1930–40 and 1940–41. Natural enemies were not sufficiently numerous to control the outbreak. The chief predators, the Carabid, *Calosoma sycophanta*, L., and the Pentatomid, *Troilus luridus*, F., were comparatively unimportant; a list is given of the 25 species of parasites and hyperparasites bred, showing their relative frequency. The most abundant were the egg-parasites, *Telenomus laeviusculus*, Ratz., *Pachyneuron* sp. and *Trichogramma* sp., which parasitised 28, 8 and 3 per cent., respectively, of the eggs in 1940. The total percentages of larvae and pupae parasitised were 22 and 6, respectively.

[MEĬER (N. F.).] **Мейер (Н. Ф.).** *Trichogramma.* (**Ecology and Results of Utilization for the Control of injurious Insects.**) [*In Russian.*]—Demy 8vo., 175 pp., 24 figs., 4 pp. refs. Moscow, Sel'khozgiz, 1941. Price 5 *rub.*

The author has summarised and brought together in this book data from the world literature on the bionomics and ecology of egg-parasites of the genus *Trichogramma*, with special reference to recent work carried out in the Russian Union on their value for pest control. The first chapter deals with the species of *Trichogramma* that have been observed in the Union [*cf. R.A.E.*, A **30** 298], and following ones with the effect of environmental and other factors on their development and fertility. *Sitotroga cerealella*, Ol., has proved so far the only suitable host for breeding the parasites on a large scale in the laboratory, and since special precautions have to be taken to prevent its spread to stored grain, attempts are being made to produce a wingless strain [**28** 635]. Further subjects dealt with are the means by which the parasite spreads in a locality, its distribution in the crown of the tree, the technique of liberation, and methods of estimating its effectiveness against pests of different crops.

The final chapter comprises a detailed survey of the practical results obtained with the various forms of *Trichogramma* in the Russian Union. The pests

against which they have proved of value include *Cydia pomonella*, L., on apple, *C.* (*Laspeyresia*) *funebrana*, Treitschke, on prunes, *C.* (*L.*) *nigricana*, Steph., and *C.* (*L.*) *dorsana*, F., on peas, *Pyrausta nubilalis*, Hb., on maize, *Phalonia epilinana*, Zell., on flax, *Loxostege sticticalis*, L., on cotton, lucerne and clover, *Heliothis armigera*, Hb. (*obsoleta*, F.) on cotton and tomatos; *Mamestra* (*Barathra*) *brassicae*, L., *Pieris brassicae*, L., *P. rapae*, L., *Plutella maculipennis*, Curt., and *Pontia* (*Leucochloe*) *daplidice*, L., on cruciferous vegetables; and *Agrotis segetum*, Schiff., on various crops. It also appeared to give some control of *Oscinella* (*Oscinosoma*) *frit*, L., on wheat.

[Alekseev (Ya. A.) & Shchepetil'nikova (V. A.).] **Алексеев (Я. А.) и Щепетильникова (В. А.) The more extensive Use of Fowls in the Control of Insect Pests.** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 3–8, 1 ref. Leningrad, 1941.

Investigations in the Ukraine on the use of fowls for the destruction of cereal bugs of the genera *Eurygaster* and *Aelia* in their hibernation quarters [*R.A.E.*, A **30** 334] are recapitulated, and the results are given of further work in the autumn of 1940, when well over 8 million hens were used for the control of these Pentatomids. When 51,000 hens were allowed to work over an area of 5,600 acres of forest in the Province of Stalin in which the numbers of hibernating bugs were almost 64 per sq. yd., the percentage of control obtained was 98. In other Provinces, it ranged from 93 to 99. The number of hens that should be used in an infested area depends on the density of the bug population [*cf. loc. cit.*], but it should never be less than 160 to clear one acre in one day. Large numbers of bugs are also destroyed when the hens are taken to fields under standing cereals or stubble. Thus, in the summer of 1938 the overwintered population in fields in the Province of Stalin was reduced by 85 per cent. At a density of about 8·3 bugs per sq. yd., 40–60 hens cleared an area of 1 acre in 1 day.

Hens have also been successfully used against the beet weevil, *Cleonus punctiventris*, Germ., in the Ukraine, both in old fields and in those actually under beet; they destroyed 90–100 per cent. of the weevils on different beet farms. It has been calculated that one hen consumes from 300 to 1,425 weevils per day. To free 1 acre from infestation, 21–45 hen-days are required, depending on the density of the weevils in the soil.

When hens are used in this way, they should be given water and feeds of grain and mineral substances in the morning and evening.

[Rubtzov (I. A.).] **Рубцов (И. А.). Effect of Temperature and Humidity on the Development of the Eggs and Larvae of the Boll Worm.** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 9–19, 4 graphs, 11 refs. Leningrad, 1941.

The following is based on the author's summary of laboratory investigations in 1937 on the effect of temperature and humidity on *Heliothis armigera*, Hb. They were made in Leningrad on the offspring of moths from pupae collected in cotton fields in Azerbaijan. The lowest and highest temperatures at which development occurred were found to be about 14°C. [57·2°F.] and 37–38°C. [98·6–100·4°F.] for the eggs, 14–16°C. [57·2–60·8°F.] and 35–36°C. [95–96·8°F.] for the larvae, and 11–14°C. [51·8–57·2°F.] and 34°C. [93·2°F.] for the pupae. The duration of development depended largely on temperature and the type of food offered. Thus, larvae that fed on tomatos and maize developed more slowly than those given leaves of *Chenopodium album* and *Senecio vulgaris*. The eggs were resistant to a wide range of temperature and humidity, and the larvae fairly so, the optimum for the latter being 27–28°C. [80·6–82·4°F.] and 100 per cent. relative humidity for the early instars and 25–26°C. [77–78·8°F.] and 80–90 per cent. for the later ones. The pupae were sensitive to

variations in humidity and were not very resistant to cold. The chief cause of larval mortality at various combinations of temperature and humidity was found to be sameness of food ; for satisfactory development, a change of food is essential, especially for the older instars, which need seeds.

If the threshold of development is assumed to be 10°C. [50°F.], the sum of effective temperatures necessary for the development of a generation is about 700 day-degrees C. [1,260 F.], so that in the areas in which the moth is a pest of cotton, 4–6 generations could be produced during a season. In the part of Russia adjoining the Baltic, however, the moth is rare, although the temperature in certain districts would in theory permit the development of two complete generations a year.

[Vinogradov (V. P.).] **Виноградов (В. П.). The Clover-seed Chalcid, *Bruchophagus gibbus*, and its Distribution in the Clover Areas of the USSR.** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 20–26, 3 refs. Leningrad, 1941.

Examination in 1936–38 of over 2,000 samples of threshed clover seed and chaff from 1,480 farms in 43 regions in the Russian Union showed that *Bruchophagus gibbus*, Boh., is present wherever clover is cultivated. The proportions of the seeds damaged by this Eurytomid in the different districts are shown in tables. Up to 15·3 per cent. of the threshed seeds were damaged and up to 97·1 per cent. of those that had been thrown out with the chaff in the process of threshing. Of all the damaged seeds, 44·69 per cent. occurred in the chaff, which is apparently one of the chief sources of infestation. Other important sources are dropped seed and seed produced by flowering clover of the second crop. It is estimated that one damaged seed out of 5 or 6 in the threshed seed contains a live larva, and one out of 13 in the chaff. The presence of living Eurytomids in the seeds was ascertained by rearing adults from them. Field and laboratory observations showed that the adults emerge when the mean temperature reaches 18–20°C. [64·4–68°F.], and they emerged in winter if the seeds were kept at this temperature and had a moisture content of at least 15 per cent. Under these conditions, emergence began in 2–3 days and was completed in 2–8 days.

For control, it is recommended that all fallen seeds and chaff should be removed from the barns or used before the adults emerge. The seeds should be passed through the threshing machine 2–3 times to separate infested ones and should be sown by machine instead of by hand, so that they are covered with a layer of soil, which prevents the emergence of the adults. In preliminary experiments, the latter were unable to make their way out from a depth of ½ in. [*R.A.E.*, A **22** 587].

[Nikitin (I. V.).] **Никитин (И. В.). Effect of fermenting Molasses on the Fecundity of the Cutworm, *Feltia segetum* Schiff.** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 36–41, 7 refs. Leningrad, 1941.

The author reviews developments in the use of traps containing molasses against the adults of *Agrotis* (*Feltia*) *segetum*, Schiff., in beet fields in the Russian Union [*cf. R.A.E.*, A **24** 643] since the method was introduced at the beginning of the century, and describes laboratory investigations in 1937 on the effects of molasses on the moths [*cf.* **27** 682]. Those used were bred from larvae fed on leaves of *Atriplex* or beet and were kept in diffused light in pairs in glass tumblers containing foliage. For comparison, they were supplied with no food or water, with water, or with solutions of sugar (1 : 10) or of fermenting molasses (1 : 3). The average females of these four groups, respectively, lived for 6·4, 8·6, 14·4 and 7·2 days, matured their eggs in 4·4, 5·1, 5·1 and 5·3 days, oviposited over periods of 2·4, 3·8, 9·8 and 2·4 days, and

laid 119·5, 328·6, 1,009·1 and 155·8 eggs. The fertility of the moths fed on molasses was somewhat higher when the dilution was increased to 1 : 10.

The detrimental effect of molasses on the moths was confirmed in similar experiments in 1938 in which a 10 per cent. solution of saccharose was substituted for sugar solution. The numbers of eggs laid per female for the four groups then averaged 201·2, 313·2, 1,154 and 341·9, of which 22·6, 10·4, 1·9 and 21·4 per cent. did not hatch.

[Znamenskaya (M. K.).] **Знаменская (М. К.). Pests of Cereal and Forage Crops in the Khibins (Murmansk District).** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 42–44, 3 refs. Leningrad, 1941.

As a result of the increased cultivation of cereals in the Province of Murmansk during the last few years, these crops are now attacked by a greater variety of insects than before, and it is suggested that some may become pests of considerable importance. A survey in 1936–39 showed that *Rhopalosiphum pruni-foliae*, Fitch (*Siphonaphis padi*, auct.) and *Macrosiphum* (*Sitobion*) *avenae*, F., were the most common and widely distributed of the injurious insects observed ; in 1938, these Aphids infested 20–53 per cent. of the ears of cereals and on one variety of wheat as many as 86 per cent. Barley was attacked by the Cordylurid, *Amaurosoma flavipes*, Fall., the larvae of which destroyed about 5 per cent. of the grains in some fields in 1938 ; wheat and timothy [*Phleum pratense*] were also injured. Sprouting oats, and particularly barley and wheat in the phase of 1–4 leaves, were attacked by the larvae of *Hylemyia* (*Chortophila*) *fabricii*, Hlmgr. ; similar injury was observed on *Agropyrum repens*, and there is some evidence that the larvae migrated to the crops from this weed. Sprouting cereals, especially wheat and barley, were attacked by the overwintered adults of *Silpha* (*Aclypea*) *opaca*, L., as soon as the snow melted and later by the larvae. The wireworms, *Corymbites sjaelandicus*, Müll., and *C.* (*Selatosomus*) *aeneus*, L., occurred in cultivated fields, and the adults of *C.* (*Paranomus*) *costalis*, Payk., were very abundant in the Khibin Mountains. Forage grasses grown for seed were injured by *Thrips major*, Uzel, the chief damage being caused in the second half of June, when the ears were still within the leaf sheaths. This thrips occurred in small numbers on barley and rye, but caused no noticeable injury. The larvae of *Oscinella frit*, L., injured the stems of barley, wheat and oats at the end of June and the beginning of August, preventing the formation of grain in the ears, but they were commoner in sprouting winter wheat at the end of August and the beginning of September.

[Kelus (O. G.).] **Келус (О. Г.). Geographical Distribution and Areas of the Gypsy-moth Outbreaks in the USSR.** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 45–52, 2 maps, 14 refs. Leningrad, 1941.

On the basis of data from the literature and unpublished material and the examination of collections in the Zoological Institute of the Academy of Sciences in Leningrad, the author gives details of the distribution in the Russian Union of *Lymantria* (*Porthetria*) *dispar*, L., and discusses the zones in which mass outbreaks periodically take place and those in which they have not occurred in spite of suitable climatic conditions. Tentative estimates of the influence of temperature and humidity in limiting the distribution of the moth are made by comparing the climatic indices characteristic of the parts of Russia in which it occurs with the results of other observations [*R.A.E.*, A **22** 143 ; **27** 314]. Mass outbreaks in these areas depend primarily on the presence of the food-plants, chiefly oak and lime [*Tilia*] and, in regions devoid of forests, on the presence of orchards, particularly apple orchards.

[Ismaĭlov (Ya. I.) & Shchichenkov (P. I.)]. **Исмайлов (Я. И.) и Щиченков (П. И.). The Egg-parasite *Trichogramma evanescens* Westw. for the Control of the Codling-moth in the Crimea.** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 58–63. Leningrad, 1941.

A detailed account is given of experiments in 1939 in orchards in the southern Crimea in which the Astrakhan and Crimean races of *Trichogramma evanescens*, Westw., were released against the first and second generations of *Cydia pomonella*, L., on apple and pear. The Crimean race [*cf. R.A.E.*, A **30** 299], which was reared from the eggs of *C. pomonella* on the southern coast of the Crimea, differs from the other races of *T. evanescens* in that it is larger in size and yellow, and apparently has no males. The orchards had been sprayed once with a stomach poison and the trees had been banded.

In one series of experiments, 4,000 parasites per tree were released in three batches against each generation of the moth, 2,000 after 15–20 per cent. of the adults had emerged, 1,000 after 30–35 per cent. had emerged and 1,000 7–8 days later. The results were satisfactory, the percentage of uninfested fruits being 90–96 for the Astrakhan race on apple and 87 for the Crimean one on pear. Comparison with control trees was not made in all cases, but the reduction in infestation due to the parasites appeared to be about 40 per cent.

The control was still better when the 4,000 parasites were liberated in six batches at shorter intervals, but the additional labour was not justified. The efficiency of the parasites was increased by the fact that the laboratory stock from which they came was preconditioned by rearing it for several generations under conditions of temperature and humidity that were not optimum but almost identical with those prevailing outdoors.

[Evlakhova (A. A.).] **Евлахова (А. А.). Results of the Tests of *Cephalosporium* Fungus in the Control of Scale Insects in the *Citrus* Groves of the Adjar Aut. Republic in 1939.** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 64–68, 3 figs. Leningrad, 1941.

A detailed account is given of experiments carried out in the region of Batum in June 1939 on the utilisation of suspensions of the spores of *Cephalosporium* [*lecanii*] for the control of *Ceroplastes sinensis*, Del G., on *Citrus*, the main results of which have already been noticed [*R.A.E.*, A **29** 582]. They also showed that the percentage infection of the Coccids with the fungus depends on the weather immediately after spraying, since the optimum conditions for the growth of the spores are 18–24°C. [64·4–75·2°F.] and 80–100 per cent. relative humidity. Nymphs and females that had not oviposited became infected, but not ovipositing females; the latter do not feed and have used the fat-body, which is a favourable medium for the development of the fungus, for the maturation of eggs.

The fungus was also effective against females of *Coccus pseudomagnoliarum*, Kuw., that were about to produce young. The suspensions tested were made with fresh or dried spores cultured on potato or spores cultured on dead cereal bugs [? *Eurygaster*]; they were applied at the rate of 1 oz. in 1 pint water, and killed 75·7, 56·8 and 74·8 per cent. of the scales, respectively, as compared with a mortality of 0–16·9 per cent. on unsprayed trees.

Evidence was obtained that the fungus overwinters in the dead Coccids of both species and develops when conditions become favourable in spring or summer. Thus, infection persisted in 1940 on plots sprayed in 1939, and up to 44 per cent. of the Coccids on both sprayed and unsprayed trees were killed by it. This ability to overwinter was confirmed by periodical culturing of spores from Coccids that had been killed by the fungus in 1939 and remained in the treated plots throughout the following winter.

[Bogatova (Z. K.).] **Богатова (З. К.). Effect of Storage Conditions on the Toxicity of Pyrethrum Extract.** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 69–70, 2 refs. Leningrad, 1941.

An account is given of an experiment in which pyrethrum extracts prepared with ethylene dichloride (dichlorethane) by a hot method of extraction [*cf. R.A.E.*, A **29** 586] and dispersed in transformer oil, kerosene or ethyl alcohol showed no appreciable loss in toxicity to *Brevicoryne brassicae*, L., as a result of storage at room temperature from 7th December 1938 to 15th August 1939.

[Voskresenskaya (A. K.).] **Воскресенская (А. К.). Physiologic Studies of the Use of Stomach Poisons in the Control of May Beetles.** [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 71–75, 9 refs. Leningrad, 1941.

An account is given of laboratory experiments carried out in 1938 to verify Tziopkalo's conclusion that dusts containing certain stomach poisons are of value against the adults of *Melolontha hippocastani*, F. [*cf. R.A.E.*, A **25** 395] and to determine the lethal doses. The beetles were collected in a forest in the Province of Voronezh, kept without food for 15–18 hours, and then fed by a modified sandwich method on leaves (usually birch) dusted with sodium fluosilicate or with calcium arsenite containing 68·52 per cent. As_2O_3 and 2·35 per cent. As_2O_5. The dosages are given as mg. per gm. live weight and mortality was calculated after 6 days. The number of beetles in a test was always less than 50 and frequently less than 10. The data for the females were inconclusive, particularly in the case of calcium arsenite, since oviposition had begun and they fed less readily. The minimum dosages of calcium arsenite that killed all the males (10) and of sodium fluosilicate that killed all the males (4) and females (10) were ·0151–0·02, 0·171–0·21 and 0·181–0·22 mg., respectively, and it is pointed out that these figures are lower than those recorded for any other insects.

This conclusion was confirmed by observations on the physiological reaction of the beetles to arsenic. No regurgitation of ingested poison was observed [*cf.* **25** 155] and arsenic introduced into the haemolymph in lethal or higher dosages frequently retarded or arrested the contractions of the fore part of the intestinal tract. This reaction is characteristic of insects that are susceptible to arsenic and favours the penetration of the poison into the haemolymph. The size of the minimum lethal dose is not, however, always a reliable criterion of the toxic effect of the poison. When leaves dusted with calcium arsenite and sodium fluosilicate were offered to the beetles, 90–100 per cent. mortality resulted at roughly the same rates of application of the dust, though the arsenical is the stronger poison. Calcium arsenite is repellent to the beetles, so that the rate of application must be high for a toxic dose to be ingested. It appears, therefore, that the two chief reactions that render insects resistant to arsenic, namely regurgitation and a low rate of consumption of the poisoned food, do not always occur together and have different physiological bases.

It is concluded that the adults of *M. hippocastani* have no specific resistance to stomach insecticides, but that the value of arsenicals may be lessened by their repellency, so that better results are to be expected from sodium and other fluosilicates.

[Dobrovol'skiĭ (B. V.).] **Добровольский (Б. В.). Food Baits as a Means of controlling Soil Pests.** [*In Russian.*]—*Bull. Rostov Sta. Plant Prot.* no. 9 pp. 113–153, 2 figs., 3 diagr., 54 refs. Rostov-on-Don, 1938. [Recd. 1942.]

Literature on the employment of baits for the control of soil pests, chiefly wireworms, is reviewed, and an account is given of experiments carried out in 1934 in the Province of Krasnodar to ascertain whether they could be used to attract the pests to certain points in a field and thus reduce the area that has to be treated with soil fumigants. Of the larvae found in the experimental

plots, the wireworms, *Agriotes gurgistanus*, Fald., and *Corymbites* (*Selatosomus*) *latus*, F., comprised 34 and 24 per cent., respectively, *Podonta daghestanica*, Rttr., 18 per cent., *Pedinus femoralis*, L., 5 per cent., and *Anisoplia* 14 per cent. The baits were applied to form 40 inch strips on or in the soil; those tested and (in brackets when stated) the approximate amounts used per strip were germinating maize seeds (8 oz.), oil-cake prepared from cottonseed, rapeseed or sunflower seed (23 oz.), bran (10½–14 oz.), sawdust, horse dung or silage (6 oz.), garlic cloves alone or added to other baits (3½ oz.), fodder beet and grated or whole potato tubers. Oils were added to the sawdust and the crumbly baits were moistened with water.

The results showed that the most attractive baits were bran, fodder beet and the oil-cakes, all of which are cheaper than the commonly used potatoes, which rapidly decayed if the soil was damp and dried out if it was dry. Horse dung, silage and sawdust or garlic alone were of no value, but mixtures of sawdust and garlic, grated potato or oil cake were moderately attractive, as also was germinating maize. The larvae were most numerous at the baits on the third day, and by the eighth only a few were found. The best time for examining the baits would, therefore, be 3–4 days after they were laid. The larvae were present longest at the oil-cakes and bran. The depth at which the baits were most effective varied with that at which the larvae occurred in the soil. Those placed on the surface and in the top layer mainly attracted *Podonta* and *Pedinus*, whereas the wireworms concentrated at baits placed at a depth of 4–6 ins. Spring appeared to be the most favourable season, and it was found that in order to obtain good results the distance between the strips of baits should not exceed 40 ins. They were considerably more effective in damp than in dry soil and when broken up into pieces of medium size than when pulverized; moistening increased their effectiveness in dry soil but caused rotting if the soil was damp. More larvae were taken at baits in a cotton field with loose well cultivated soil free from weeds than in fallow land or a stubble field in which the soil was compact and covered with weeds, which evidently attracted the larvae more than the baits. The most effective baits, such as oil-cake and bran, were attractive to all the larvae, but particularly so to the wireworms; *Podonta* and *Pedinus* were chiefly found in bran and rapeseed oil-cake, and *Anisoplia* appeared to prefer root-crop baits and sunflower-seed oil-cake.

The radius over which the baits were effective did not exceed about 1 ft.; the maximum distances from which *A. gurgistanus* and *Podonta* were attracted to baits were 36 and 20 ins., respectively. Observations on the wireworms and *Podonta* in a glass case showed that they wander at random until they come within 4–6 ins. of a bait, when they move towards it. It is estimated that if the distance between the strips of bait were 2 ft. the dosages of chloropicrin in use at present could be halved, which would result in a saving of some 200 lb. per acre and would more than offset the cost involved.

Janjua (N. A.) & Samuel (C. K.). **Fruit Pests of Baluchistan.**—*Misc. Bull. Coun. agric. Res. India* no. 42, 41 pp., 3 pls., 35 refs. Delhi, 1941.

Lists based on recent surveys and the literature are given of nearly 80 species of insects that attack fruit and nut trees, vines and cucurbits in Baluchistan, together with notes on their distribution and on the bionomics of many of them. Some of the less well-known pests stated to be of major importance are mentioned below.

Empoasca decipiens, Paoli, feeds on the leaves of grape-vines, causing discoloration and defoliation. This Jassid has 4 generations a year, and the adults overwinter under dead grass or other shelter and emerge in early April; they attack the fresh foliage as soon as the buds open and feed for two or three weeks before ovipositing. Females lay about 100 eggs singly beneath the lower epidermis of the leaf. *Lachnus* (*Pterochlorus*) *persicae*, Cholod., infests the

stems and branches of almond and stone fruits and produces quantities of honey-dew, on which a sooty fungus grows. As a result of attack by this Aphid, the tree loses a considerable amount of sap, very few fruits mature, and in extreme cases no fruits are produced, while the growth of the tree is retarded. Reproduction is viviparous and parthenogenetic, except for the generation that produces the winter eggs, which are laid in clusters on stems and branches during November and December and hatch in April. Alates are produced after 3–4 generations in spring. Breeding is rapid during spring and autumn, but is reduced in summer. The adults are parasitised by *Pachyneuron nazeeri*, Mani [*cf. R.A.E.*, A **28** 510]. *Aspidiotus prunorum*, Laing, is a serious pest of almond and also attacks apple, plum and cherry. The seasonal history of this Coccid resembles that of *A. perniciosus*, Comst. [*cf.* **24** 692], and it causes similar damage. *Eriochiton amygdalae*, Rao [**28** 559] attacks the branches of almond and to a less extent those of peach, apple and quince, and reduces the vitality of the tree, ultimately killing it. The females produce up to 300–400 eggs each, which remain beneath the female scale and hatch in spring. The nymphs settle on the branches, twigs and buds. With the approach of autumn, winged males appear and fertilise the females, which die soon after oviposition.

Tortrix (*Cacoecia*) *subsidiaria*, Meyr., attacks plum, peach and, occasionally, apple; its bionomics are almost identical with those of *T.* (*C.*) *sarcostega*, Meyr. [**27** 51]. The Arctiid, *Axiopoena maura*, Eichw., attacks the leaves of apricot and has two generations a year, overwintering as a pupa in the soil.

Larvae of *Capnodis kashmirensis*, Fairm., tunnel in the bast layer of the trunks and branches of peach and apricot trees, destroying large areas of bark and sometimes killing the trees. This Buprestid also attacks many road-side and ornamental trees. The adults are active from June to early October and oviposit in the bast or in crevices in the bark. The life-cycle lasts a year. The Cerambycid, *Aeolesthes sarta*, Solsky, causes much damage to apple, quince, walnut, apricot and shade trees, and also infests almond and peach. Eggs are deposited in wounds in the bark, each female laying about 50, and the larvae feed in the sapwood and girdle the tree with their galleries, sometimes killing it in 3–4 years. The adults appear early in May and are abundant throughout June. They pair soon after emergence and oviposition follows within ten days. Another Cerambycid, *Quettania coeruleipennis*, Schwarzer, attacks the top shoots and small branches of cherry, usually of old trees. The larvae tunnel downwards in the shoots and remain active throughout the winter, and the adults emerge in May, the life-cycle lasting a year. The adults and larvae of *Scolytus amygdali*, Guér., bore beneath the bark of stone fruits, almond, apple and quince. The females form their egg-galleries in the bast, and lay 50–70 eggs each. The larvae hatch in 1–2 days, tunnel at right-angles to the egg gallery and pupate after about a month. The pupal stage lasts a fortnight, and there are 4 generations a year. Adults of the Cetoniids, *Epicometis squalida*, L., *E. turanica*, Rttr., and *Stalagmosoma albella*, Pall., which appear in April, cause severe damage to cherry blossom, attacking the essential organs of the flowers, and considerably reduce the setting of the fruit. They are active during the day but hide in crevices in the soil at night. Eggs are deposited in the soil early in May at a depth of 2½–5 ins.; the larvae hatch early in June, feed on organic matter in or on the soil, and pupate at the beginning of the following March. In addition to cherry, *E. turanica* attacks most fruit blossom, particularly peach, pear and apple.

CHERIAN (M. C.) & BRAHMACHARI (K.). **Notes on three predatory Hemipterons from South India.**—*Indian J. Ent.* **3** pt. 1 pp. 115–119, 3 refs. New Delhi, 1941.

Daincha (*Sesbania bispinosa*), which is an important green manure plant in the Madras Presidency, is attacked by larvae of *Prodenia litura*, F., and

Semiothisa pervolgata, Wlk., and also by those of *Terias hecabe*, L., and *Catopsilia pyranthe*, L., which are less numerous. Two Pentatomids and a Reduviid are predacious on these caterpillars, and observations were made on their bionomics. Both nymphs and adults of *Cantheconidia furcellata*, Wolff, were observed to attack the larvae of *S. pervolgata*, *T. hecabe* and *C. pyranthe* in the field. Eggs are laid a few inches below the tip of the growing point of the shoot or on the leaves, 8–60 being deposited at a time. The maximum number laid by a single female was 180. The eggs hatched in 5–7 days, and development to the adult stage lasted 18–21 days ; the adults lived for 15–20 days.

Andrallus spinidens, F., attacks all the four Lepidoptera that occur on *Sesbania*, but does not appear until April, when they have almost completed one generation. The optimum conditions for it are a maximum temperature of 94–104°F., a minimum of 70–80°F., and low relative humidity ; it is most active and numerous during the south-west monsoon (May–September). The females oviposit 2–3 days after emerging, depositing 28–160 eggs at a time. The maximum number laid per female was 256. The egg and nymphal stages lasted 6–9 and 18–21 days, respectively, and adults lived for 15–20 days in the laboratory.

The Reduviid, *Rhynocoris fuscipes*, F., was observed in small numbers in two districts of the Presidency feeding on the daincha caterpillars and also on *Aulacophora foveicollis*, Lucas, and beetles of the genus *Epilachna*. Its eggs are deposited in batches of 5–21, the total laid by a single female varying from 45 to 80. The egg and nymphal stages lasted 6–7 and 30–50 days, respectively, and the adults survived for up to 3 months.

In the laboratory, all three predators attacked the larvae of many other species of Lepidoptera, a list of which is given, but as each individual bug destroyed only 2 or 3 larvae in a day, they are considered unlikely to exert any material control. The newly-hatched nymphs of the two Pentatomids were observed to feed on plant sap for a few days before attacking insects. The adults of all three bugs were attacked by a bacterial disease, which was most prevalent during the rainy season. Eggs of *Cantheconidia* were parasitised by a Scelionid tentatively determined as *Microphanurus seychellensis*, Kieff.

[Negi (P. S.).] **Entomological Section.**—*Rep. Indian Lac Res. Inst. Namkum 1940–41* pp. 20–28. Ranchi, 1941.

The host trees of *Laccifer lacca*, Kerr, were attacked by the usual pests [*cf.*, *R.A.E.*, A **29** 263, 264] at Namkum, Bihar, in 1940–41, and identifications of several others were received. These comprised the Lycaenids, *Arhopala amantes*, Hew., and *A. rama*, Koll., on leaves of *Shorea robusta* and *Schleichera trijuga*, the Noctuids, *Paectes subapicalis*, Wlk., and *Lophoptera illucida*, Wlk., on leaves of *S. robusta*, and the Curculionid, *Endaeus buteae*, Mshl., and the Tortricids, *Enarmonia stirpicola*, Meyr., and *Acroclita cryptiolitha*, Fletch., on flowers of *Butea frondosa*. The third generation of the parthenogenetic strain of *L. lacca* established in 1939 [*cf.* **29** 265] began to develop satisfactorily. The parasites attacking *L. lacca* were the same as in the previous year and the percentage parasitism in the Institute plantation was again 6, but it was 53·3 in one of the lac crops in villages in another district in Bihar. *Eublemma amabilis*, Moore, and *Holcocera pulverea*, Meyr., continued to be the major predators, and *Chrysopa* sp. was the most important of the others. In the course of work on the control of *E. amabilis* by *Microbracon greeni*, Ashm., and *M. hebetor*, Say, and of *H. pulverea* by *M. hebetor*, it was found that the latter is an indigenous parasite of an unidentified species of *Ephestia* that attacks *Bassia latifolia*, which is common in some lac-growing areas ; it is not known whether the Braconid will attack its natural host in preference to predators of *L. lacca*. In view of the scarcity of larvae of the predators during certain seasons of the year and the consequent difficulty of breeding the Braconids in

the laboratory, investigations were made on the preservation of living host larvae by injections of 2–5 per cent. solutions of acetic, formic and lactic acids and 10 per cent. glucose and glycerine or periodical paralysation by the Braconids. The larvae could be kept soft for a maximum period of 10 days with acid injections, but the Braconids did not generally oviposit on hosts so treated, though middle-stage Braconid larvae completed their development on them. Periodical paralysation kept the host larvae soft for a maximum of 18–29 days, but development of the parasite from egg to adult took place in only one instance on one of these larvae. Breeding of *Trichogrammatoidea nana*, Zhnt. and *Trichogramma minutum*, Ril., was continued. Although both parasites readily attack the eggs of *Eublemma amabilis* and develop in them, the adults find difficulty in emerging. The use of linseed oil as a repellent on the cards carrying parasitised eggs prevented newly hatched larvae of *Ephestia* sp., which is a good laboratory host for the Trichogrammatids, and *H. pulverea* from damaging parasitised eggs, and had no ill effect on the emerging parasites, provided that the cards were not made too moist. Other parasites of lac predators [*cf. loc. cit.*] included *Pristomerus testaceicollis*, Cam., which was found for the first time attacking *Eublemma* as well as *Holcocera*, and *Apanteles tachardiae*, Cam., which is the most important indigenous parasite of *Holcocera* and should be tried in the field if *M. hebetor* continues to give indifferent results ; *A. tachardiae* emerged in cages from both mature and immature lac.

The results of experimental liberations of *M. greeni* and *M. hebetor*, which were poor, are shown in tables. *M. greeni* was found to spread to a maximum of 300 ft. from the point of release.

Ramaswami (S.), Sarma (P. S.) & Sreenivasaya (M.). **Studies in Insect Nutrition.—Assay of " Quality " in Crops.**—*Curr. Sci.* **11** no. 2 pp. 53–54. Bangalore, 1942.

Investigations in which larvae of *Corcyra cephalonica*, Staint., were fed on samples of sorghum and ragi [*Eleusine coracana*] showed that there is a close correlation between the nutritive value of the cereal, expressed as total nitrogen and ether extract (fat), and the increase in weight of the larvae, and it is suggested that this insect might be used to assess the comparative food value of cereal crops. As only about 20 gm. food are required for the test, the method is applicable to plants grown in pots.

Ocfemia (G. O.), Macaspac (I. S.) & Yuan (Hsieh Feng). **Experimental Transmission of the Mosaic of** *Canna indica*.—*Philipp. Agric.* **30** no. 5 pp. 357–370, 2 pls., 9 refs. Los Baños, P. I., 1941.

The following is based largely on the authors' summary of experiments in the Philippines in 1939–41 on the transmission of the virus that causes mosaic of *Canna indica*, which is prevalent in Davao and resembles the mosaic disease of Manila hemp [*Musa textilis*] that occurs there [*cf. R.A.E.*, A **29** 316].

Aphis gossypii, Glov., and *A. maidis*, Fitch, both transmitted the virus from *C. indica* to *M. textilis*, and *A. gossypii* also transmitted it to *C. edulis* and two varieties of ornamental *Canna*, although it cannot transmit mosaic of *M. textilis* to these plants. It did not transmit it from *C. indica* to cucumber or cotton. *A. gossypii* transmitted the virus to *M. textilis* after feeding on infected *C. indica* for about five minutes, and five Aphids sufficed to effect transmission. All the virus in an infected Aphid passed into the first plant on which it fed after becoming infected, and after individuals that had fed on infected *C. indica* had been kept in a test-tube for an hour, they could no longer transmit the disease to *M. textilis*. The virus was not transmitted by *A. laburni*, Kalt., *Pentalonia nigronervosa*, Coq., or *Rhopalosiphum nymphaeae*, L., which is also unable to transmit the mosaic of *M. textilis* to *C. edulis* and ornamental *Canna* [*cf.* **29** 317]. The symptoms caused by the virus in *C. indica*

are described. Those caused by it in *M. textilis* are similar, and they differ from those of the mosaic of *M. textilis*. The symptoms also differ in their advanced stages in *C. indica*. It is not known whether the mosaic of *C. indica* is identical with that of *M. textilis*, but the presence of infected *C. indica* constitutes a source of infection for *M. textilis*.

AGATI (J. A.), SISON (P. L.) & ABALOS (R.). **A Progress Report on the Rice Maladies recently observed in Central Luzon with special Reference to the "Stunt or Dwarf" Disease: 1.**—*Philipp. J. Agric.* **12** no. 2 pp. 197–210, 7 pls. (2 col.), 13 refs. Manila, 1941.

During investigations on stunting and yellowing of rice plants recently observed in the Philippines, examination of individual plants revealed three distinct types of symptoms. The first comprised stunted growth and general yellowing of the whole plant, and was usually associated with dry and poor soil, while the other two were associated with attack by leafhoppers [*cf. R.A.E.*, A **28** 206], of which *Nephotettix bipunctatus*, F.,* was the most abundant, though *N. apicalis*, Motsch.,* *Deltocephalus dorsalis*, Motsch., and a Delphacid occurred in association with it. The second type comprised stunted growth and the gradual yellowing and drying of individual leaves; the yellowing spread from the tip down the base of each leaf, and the lower leaves were affected first. This type usually occurred in localised patches, but sometimes involved considerable areas, depending on the number of leafhoppers present. The third type of stunting was comparatively rare, and occurred only in small patches in the field. The essential feature distinguishing it from the other types was the presence of interrupted yellowish-white streaks on the upper young leaves of affected plants. Almost all but the first few leaves at the base of the plant showed fine white streaks along the leaf parallel to the midrib. The first manifestation is the appearance of yellowish-white dots along the veins of an unfolded leaf, which gradually coalesce to form streaks as the leaf develops. Affected leaves were short, narrow and stiff, and the plants were stunted and the internodes short. Numerous tillers were produced, resulting in a rosette crown. This type of disease appears to be new in the Philippines, but it is similar to, if not identical with, dwarf or stunt disease of rice in Japan, which is caused by a virus [*Marmor oryzae* of Holmes] transmitted by *N. apicalis cinticeps*, Uhl., and, at least under experimental conditions [**26** 167] by *D. dorsalis*. Since leafhoppers were always found associated with plants showing stunting and yellowing in the Philippines, experiments were carried out on their relation to these affections with special reference to stunting. The technique is described in some detail.

Adults of *N. bipunctatus* were collected in the field and allowed to breed in the laboratory and transmission experiments were carried out with the third filial generation and subsequent progeny, since the virus has been shown in Japan to be transmitted through the egg of *N. apicalis cincticeps* to the third generation [**23** 622; but *cf.* also **29** 272]; the rice plants used for breeding showed neither stunted growth nor streaks on their leaves after two months of growth. When batches of 2, 4, 8, 12 and 16 fifth-instar nymphs were caged on individual healthy rice plants, they caused yellowing of individual leaves corresponding to the second type of symptoms and varying in extent with the number of leafhoppers present. The plants on which 12 and 16 leafhoppers were placed were

* The identity of the Jassids recorded under these names is uncertain. Kirkaldy (*Bull. Div. Ent. Exp. Sta. Hawaii. Sug. Plant. Ass.* **3** p. 54) considered *Cicada bipunctata*, F., *Pediopsis apicalis*, Motsch., and *Selenocephalus cincticeps*, Uhl., to be synonymous and used the name *Nephotettix apicalis* because *bipunctata*, F., was preoccupied in *Cicada*. This synonymy has been accepted by Japanese workers, except that they regard *cincticeps*, the Japanese form, as a subspecies. The fact that it is recorded as *N. apicalis cincticeps* in some Japanese papers and *N. bipunctatus cincticeps* in others is due to lack of agreement as to whether *bipunctatus* is an available name for the species.

severely stunted, and died in 4 weeks and 1 week, respectively. None of the plants had developed streak by the end of the experiment, which was continued for more than 60 days. In investigations on virus transmission, two healthy rice seedlings were caged with a severely affected plant collected from the field, and as soon as the seedling produced young healthy leaves, four adults of *N. bipunctatus* were introduced. About 20 days later, yellowish streaks appeared on the youngest leaf of one of the seedlings, thus indicating that the disease is caused by a virus and that it is transmitted by *N. bipunctatus*. Subsequently, nine small plots were planted with two seedlings each and caged; 35–41 days after the seedlings had germinated, one leafhopper that had been allowed to feed for 3–5 days on a young diseased leaf was introduced into each of seven cages. Five of the 14 plants developed the disease; the first few lower leaves remained healthy, but after the appearance of one affected leaf, all subsequent leaves showed white specks that later developed into linear streaks similar to those found in the field. The other plants and the controls remained healthy. In a further experiment, seedlings sterilised by hot-water treatment were set in petroleum cans containing rich soil, caged and exposed to the maximum amount of sunshine. When the plants were 39–50 days old, nymphs and adults of *N. bipunctatus* that had fed for 3–5 days on infected plants were introduced into the cages. All the plants developed stunt disease, the first symptom appearing 12 days after the introduction of the Jassids.

Tests under similar conditions with *N. apicalis*, *D. dorsalis* and the Delphacid gave negative results.

Otanes (F. Q.) & Sison (P. L.). **Pests of Rice.**—*Philipp. J. Agric.* **12** no. 2 pp. 211–259, 18 pls. (4 col.), 1 fig., many refs. Manila, 1941.

This paper includes a list of insects that attack rice in the Philippines, together with notes on their bionomics and control. The major pests comprise *Locusta migratoria manilensis*, Meyen, *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), the eggs of which are parasitised by *Telenomus* (*Phanurus*) *dignus*, Gah., *T.* (*P.*) *rowani*, Gah., and *Tetrastichus schoenobii*, Ferrière; *Scirpophaga innotata*, Wlk., *Chilo simplex*, Btlr., *Sesamia inferens*, Wlk., *Spodoptera mauritia*, Boisd., *Prodenia litura*, F., *Leptocorisa acuta*, Thnb., *Nymphula depunctalis*, Gn., two species of *Nephotettix* [see preceding abstract], *Amblycephalus* (*Cicadella*) *spectra*, Dist., *Delphacodes* sp., *Nisia atrovenosa*, Leth., and *Leucopholis irrorata*, Chevr., which is parasitised by *Campsomeris aureicollis*, Lep. The minor pests include *Cnaphalocrocis medinalis*, Gn., which is usually kept in check by natural enemies, the most important of which are *Brachymeria excarinata*, Gah., and *Apanteles angustibasis*, Gah., *Melanitis ismene*, Cram., *Parnara mathias*, F., *Oxya velox*, F., *Gryllotalpa africana*, P. de B., *Byrsocrypta* (*Dryopeia*) *hirsuta*, Baker, *Verania discolor*, F., and *Monolepta bifasciata*, Hornst. The principal insect pests of stored rice are *Calandra* (*Sitophilus*) *oryzae*, L., *Sitotroga cerealella*, Ol., and *Corcyra cephalonica*, Staint.

Veitch (R.). **Report of the Director of Plant Industry (Research).**—*Rep. Dep. Agric. Stk Qd 1940–41* pp. 5–9. Brisbane, 1941.

The section of this report (p. 7) dealing with entomological investigations in Queensland in 1940–41 includes a brief account of work on the control of the corn ear worm [*Heliothis armigera*, Hb.] on cotton. It was found that, in spite of the variation in infestation in widely separated cotton-growing districts, general recommendations for the application of an insecticide to cotton carrying a reasonable crop of bolls and squares might justifiably be issued after the occurrence of enough rain to cause considerable egg-laying. The use of a trap

crop of maize [*cf. R.A.E.*, A **26** 494] in districts other than the Callide Valley did not give very satisfactory results. Lures of pollard and ammonia and of yeast and ammonium carbonate were effective against the Queensland fruit-fly [*Dacus ferrugineus tryoni*, Frogg.] in *Citrus* orchards, though they trap other insects as well as the fruit-flies. The predator [*Dactylosternum hydrophiloides*, Macl.] introduced against the banana weevil borer [*Cosmopolites sordidus*, Germ.] [*cf. R.A.E.*, A **29** 466] was found to be increasing rapidly.

Although there was considerable hatching of the Australian plague locust [*Chortoicetes terminifera*, Wlk.] in spring, drought conditions virtually eliminated the population, and no outbreak occurred. The spur-throated locust [*Austracris guttulosa*, Wlk.] was again common in some sub-coastal localities, and one large swarm was reported late in June. In the Theodore district, it migrated from Rhodes grass [*Chloris gayana*] to cotton. Infestation by the sorghum midge [*Contarinia sorghicola*, Coq.] was unusually severe, particularly on the eastern Darling Downs ; losses were consistently heavy in varieties of sorghum that mature their tillers over a relatively long period, and the improvement of tillering habits in commercial varieties is a possible method of control. The examination of samples of wheat from receiving sheds on the Darling Downs provided little evidence that infestation by the rice weevil [*Calandra oryzae*, L.] takes place in the field.

The lantana bug [*Teleonemia scrupulosa*, Stål] gave considerable control of *Lantana* [*camara*] in the coastal and hinterland country north of Townsville, and several colonies were liberated further south during the summer [*cf.* **30** 155].

DUMBLETON (L. J.) & DICK (R. D.). **The Subterranean Grass Caterpillar, *Oxycanus* sp., chemical Control Investigations, 1940 Season.**—*N.Z. J. Sci. Tech.* **22** no. 6A pp. 309A–322A, 1 fig., 3 refs. Wellington, N.Z., 1941.

An interim report is given of investigations, carried out in two localities in the South Island of New Zealand, on the control of the larvae of the genus *Oxycanus* by baits, sprays or dusts that could be applied to pastures after they are observed to be infested and before the damage is irreparable. Since the damage does not become apparent before May and most of the larvae finish feeding by the end of August [*cf. R.A.E.*, A **29** 542], control should be attempted as early as possible between these dates. Baits containing 25 lb. bran, 8 lb. molasses and 3 gals. water poisoned with 1 lb. sodium arsenite, sodium fluoride or Paris green or 5 lb. derris (3 per cent. rotenone) were applied at the end of June or the beginning of July at the rate of 60 and 120 lb. per acre, and a similar bait containing 20 lb. derris (0·36 per cent. rotenone) at 80 and 160 lb. per acre. Observations continued until early September showed that baits containing sodium arsenite and sodium fluoride were relatively ineffective, whereas that containing Paris green reduced the larval population by 77 per cent. at the lower rate and by 63 per cent. at the higher rate on ground that was practically bare of grass and by 87 per cent. at the higher rate on ground that still bore grass ; derris (3 per cent. rotenone) gave a reduction approximating to that given by Paris green, but the latter was the only treatment that resulted in a recovery of the grass or an improvement of the existing sward.

The sprays consisted of 6 lb. Paris green, lead arsenate, calcium arsenate or sodium arsenite, 1 lb. calcium caseinate and 100 gals. water, applied at the rate of 100 gals. per acre, and the dusts of 6 lb. lead arsenate, calcium arsenate or sodium arsenite in 60 lb. hydrated lime at 66 lb. per acre and derris (0·36 per cent. rotenone) at 60 lb. per acre. All treatments were made at the beginning of July ; the first two sprays gave 63 and 40 per cent. reduction in population, respectively, but there was no recovery of the grass, and the other sprays and the dusts were ineffective. The cost of the treatments is given.

Carter (Walter). **Insects and the Spread of Plant Diseases.**—*Rep. Smithson. Instn 1940* pp. 329–342, 6 pls. Washington, D.C., 1941.

The author discusses the ways in which insects spread plant diseases, by carrying on or in their bodies the spores of fungi and bacteria, with which they contaminate blossoms or wounds on the plant, by injecting injurious fluids into the plants in the course of feeding, or by transmitting viruses from diseased to healthy plants, and the effect of climate on these activities. He points out that the occurrence of insect-transmitted diseases of plants is world-wide and gives a brief account of some of the control measures now in use and the probable lines of development in this field in the future.

White (W. H.). **The Mexican Bean Beetle.**—*Rep. Smithson. Instn 1940* pp. 343–356, 6 pls. (1 col.), 1 map. Washington, D.C., 1941.

An account is given of the introduction of the Mexican bean beetle, *Epilachna varivestis*, Muls., into Alabama from the south-western United States in 1920 and of its subsequent rapid spread in a north-easterly direction, with details of its life-history in the eastern States, the damage it causes, the natural factors, such as drought and high temperature, that reduce its numbers and the development of control measures against it.

Lincoln (C.) & Palm (C. E.). **Biology and Ecology of the Alfalfa Snout Beetle.**—*Mem. Cornell agric. Exp. Sta.* no. 236, 45 pp., 12 charts, 8 refs. Ithaca, N.Y., 1941.

The following is based on the authors' summary of laboratory and field investigations in 1934–40 on the bionomics of *Otiorrhynchus* (*Brachyrrhinus*) *ligustici*, L., a weevil that has been introduced into North America and occurs there in only two areas in New York, totalling 150 sq. miles, on the southern and eastern shores of Lake Ontario, where about 3,000 acres of lucerne and clover are involved [*cf. R.A.E.*, A **23** 465, etc.]. *O. ligustici* is a wingless, parthenogenetic weevil; the adults feed on the foliage of lucerne and other plants, but the principal injury is caused by the larvae, which attack the roots of lucerne, clover and many weeds. Most of the eggs are deposited in the upper two inches of soil, close to the food-plant. No consistent differences in the duration of the egg stage were observed at soil moistures of 3–13 per cent., but the period was prolonged at 2·5 per cent. The minimum duration was 9–10 days at 75–80°F. and the maximum 74 days at 50°F. The life-cycle is normally completed in two years, but a small percentage of the larvae do not pupate until the third summer, so making the life-cycle last three years. The weevil has been reared from egg to adult on lucerne, clovers (*Trifolium*), sweet clovers (*Melilotus*) *Rumex* spp., wild carrot (*Daucus carota*), *Achillea millefolium*, chicory (*Cichorium intybus*), vetch (*Vicia angustifolia*), *Taraxacum officinale*, *Agropyrum repens*, *Fragaria virginiana* and *Potentilla recta*. The larvae feed at a greater depth in sandy than in gravelly or loam soils and are nearer the surface if populations are heavy; they move down to hibernate in November and December, when soil temperatures drop to 40–45°F.

Larval development does not occur at a constant temperature of 83°F., and is considerably retarded at or below 60°F. Pupae and adults appear earlier in light well-drained soils than in heavier soils, and the dates of pupation and transformation are correlated with spring temperatures and the thawing of the soil. The first larvae to pupate and the first pupae to transform are those nearest the surface of the soil, because of the higher temperatures prevailing there. The pupal stage lasted 61·1 days at 50°F. and 11·4 at 85°F. Adults move upward within a few days after the soil has thawed in spring; this vertical

movement takes about 10 days and usually occurs when soil temperatures are below 44°F. Adult migration begins in the latter part of April, and the weevils are most active at soil-surface temperatures of 70–78°F.

Eggs were obtained from weevils that fed on plants of 21 species when confined to them, but there were great differences in the numbers of eggs laid. The optimum temperatures for oviposition were 75 and 80°F., but it occurred between 50 and 85°F. Larvae will pupate without first being exposed to low temperatures, but mortality is high and a longer period at warm temperatures is required. Adults will sometimes oviposit at summer temperatures after exposure to a few weeks of cold in a refrigerator as a substitute for winter cold, but the rest period is only partly broken. Eggs will not hatch at constant temperatures above 85°F., and even under favourable conditions, more than 30 per cent. of the eggs fail to hatch. Field mortality among the feeding larvae in the summer and autumn is high in the case of dense populations, and very low with sparse populations. Destruction by skunks accounts for a large part of this mortality, while an entomophagous fungus may also be important [*cf.* **23** 558]. Winter mortality of the larvae is about 75 per cent., but there is little mortality among the pupae and adults in the soil, according to data obtained from diggings. Hibernation-cage records indicated that this figure for larval mortality is too high. In sheltered places with ample snow cover, adults survived the winter with less than an inch of soil protection.

Palm (C. E.), Lincoln (C.) & Buchholz (A. B.). **The Alfalfa Snout Beetle: its Control and Suppression.**—*Bull. Cornell agric. Exp. Sta.* no. 757, 50 pp., 14 charts, 9 figs., 9 refs. Ithaca, N.Y., 1941.

This paper consists of two parts, of which the first (pp. 5–36) is by Palm & Lincoln and includes a brief account of the bionomics of *Otiorrhynchus* (*Brachyrrhinus*) *ligustici*, L., on lucerne in New York State [*cf.* preceding abstract]. The following is based on their summary of experiments on control.

Direct control is best obtained with poisoned baits applied against the adults when they first become active above ground in late April or May. Fruit baits and baits containing both sugar and soy-bean flour proved the most effective of those tested. Cultural control measures should be used in conjunction with baits. The first application of bait is made when the weevils begin to feed on lucerne foliage or migrate to ploughed ground; this usually occurs during the last week in April. Ordinarily three applications are made at approximately weekly intervals, at the rate of 1 bushel of bait per acre per application. Raisins and dried peaches, apricots, figs and dates make effective baits when soaked, mixed with shorts and sodium fluosilicate, and put through a food-chopper. Of these, raisin bait is the most satisfactory [*cf. R.A.E.* A **25** 180; **29** 357, etc.]. Chopped fresh apples and sodium fluosilicate make an effective bait. Crushed maize cobs proved to be the most satisfactory carrier for mixed baits. Bran, ground-nut hulls, and cracked maize are also good, but sawdust, peat moss, maize silage, horse manure, chopped maize stalks, dried sugar-beet pulp, and dried citrus peelings are less effective or have other disadvantages. Granulated sugar mixed with soy-bean flour is the best attractant so far tested. Fermenting solutions such as cider and beer are attractive, but remain effective for only a short time in the field. Molasses is repellent. Aromatic compounds do not improve the baits, although some are attractive in dilute water solutions. Soy-bean flour acts both as an attractant and as a conditioner, keeping the bait moist. Attempts to use oils and other compounds as conditioners have not been very successful, although gum karaya has given promising results. Sodium benzoate is an efficient preservative for raisin bait but not for maize cob bait. In cob baits, 1 per cent. of commercial formalin (40 per cent. formaldehyde) works well. Cob baits spoil faster than raisin bait and require a preservative. Commercial cold storage keeps raisin bait in perfect condition.

Sodium fluosilicate and sodium fluoride are effective poisons, while sodium arsenite is slightly less effective. A synthetic cryolite, Paris green, white arsenic, calcium arsenate and Epsom salts [magnesium sulphate] are ineffective. At least 3 lb. sodium fluosilicate is required to 100 lb. raisins and shorts, and 6 lb. to 100 lb. of cobs ; 5 and 8 lb., respectively, were generally used to give a margin of safety. Fowls will not eat bait containing fluosilicate, but raisin bait is readily eaten by cows. Bait tests at controlled temperatures showed that there is little difference between 70 and 90°F., but below 70° the rate of kill is retarded. Some good kills were obtained with calcium-arsenate sprays and dusts [*cf.* **25** 180], but the fast growth of lucerne foliage makes it difficult to maintain a coverage. A straight-walled trench [*cf.* **25** 179] with a strip of bait in front of it is an almost completely effective barrier. Without the bait, a good trench is about 90 per cent. effective, but a poor one is worthless. A strip barrier of naphthalene [*cf.* **25** 180] is about 75 per cent. effective, while a barrier of galvanised iron and wood is almost completely effective. Bait is much more effective on ploughed ground than in competition with lucerne. Practices that facilitate control are clean autumn ploughing, sowing on uninfested ground, protecting uninfested lucerne with baited dead furrows, and using fewer and larger meadows. Growing red clover or some other hay crop and omitting lucerne from the rotation for several years facilitates the cleaning up of the land. Shallow ploughing and disking is not effective in destroying the larvae mechanically. The most effective soil fumigant is carbon bisulphide [*cf.* **29** 199].

The second part (pp. 37–50) is by Buchholz and describes the campaign for the eradication of the weevil. The following is taken from his summary. Since its discovery in 1933 [*cf.* **21** 476], scouting has been carried out each year to determine its distribution ; and it is believed that only a few light infestations remain undiscovered. Since 1936 all fields known to be infested have been baited. Raisin-shorts bait was used almost exclusively for the first three years but in 1939 some maize cob bait was used in addition to the raisin bait [*cf.* **29** 252], and in 1940 the maize cob bait completely replaced the raisin bait. All infested fields have been mapped, and complete records have been kept. In addition, extensive counts have been made to determine the effectiveness of the control programme. These counts show a high percentage of kill and a marked reduction in the subsequent infestation. A thorough extension programme has been carried on, to acquaint the farmers with the nature of the suppression programme and to urge them to follow proper cultural practices that will help in the control of the weevil. The principal danger of long-distance spread of *O. ligustici* appears to be through accidental carrying of the adults by human agency and not on any specific plant products that could be quarantined. The adults are apparently readily transported by moving water.

Smith (L. G.). **Pear Psylla in Washington.**—*Ext. Bull. St. Coll. Wash.* no. 255 revd., 8 pp., 5 figs. Pullman, Wash., 1941.

Intensive surveys carried out in Washington since *Psylla pyricola*, Först., was first observed there in 1939 [*cf. R.A.E.*, A **29** 48, 425] showed that most infestations were light, though the Psyllid had evidently been present in two districts for several years. The adults overwinter under the bark of pear and other trees or under débris and emerge in early spring. Their eggs are laid in crevices round buds and on small branches and fruit spurs of pear during the early stages of the swelling of the buds and hatch in 9–28 days, depending on temperature. The nymphs migrate to the buds and settle on the petioles and fruit stems, passing through five instars, each of which lasts about five days. During the summer the eggs are laid along the midrib on the underside of the leaves and the nymphs are usually found on the lower surfaces of the leaves. There appear to be at least four generations in the year in Washington.

The feeding of the nymphs causes the leaves to drop prematurely, and their honey-dew runs down over the leaves and fruit below them. The sooty fungus that grows in this honey-dew causes the appearance of dead areas in the leaves and scalding and deformity of the fruit. An eradication programme was begun in March 1940; it comprised surveys to determine the position of healthy and infested pear trees, treatment with delayed-dormant sprays of mineral-oil emulsions (3·2 per cent. actual oil) and with up to five sprays of nicotine and oil against the nymphs after the fruit was set, the removal of unprofitable trees and the promulgation of a quarantine to regulate shipments of commodities from the infested areas.

Cross (J. C.). **A simple Method of controlling Termites.**—*Science* **95** no. 2469, p. 433. Lancaster, Pa., 1942.

The author states that he has obtained freedom from termites in his home in Texas by pouring about a quart of used crankcase oil into a small ditch round each of the concrete piers supporting the building and a proportionate amount round the base of the chimney. Some concrete steps were overlooked, and this was the only point at which termites subsequently entered the building. After they were protected with the oil no further trouble was experienced, though the surrounding soil was heavily infested. The oil remained in the ground for a long time, did not diffuse more than a few inches from the ditches, and did not appear to affect the growth of shrubs 6 inches away.

Service and Regulatory Announcements, October-December 1941.—*S.R.A., B.E.P.Q.* no. 149 pp. 87–104. Washington, D.C., U.S. Dep. Agric., 1942.

Administrative Instructions (B.E.P.Q. no. 518) relating to Quarantine no. 58 authorise the movement of green string beans, lima beans, faba beans and pigeon peas [*Cajanus cajan*], in the pod, from Porto Rico into any other State, Territory or District of the United States, provided that they have been fumigated [for the control of insects, notably *Maruca testulalis*, Geyer (*cf. R.A.E.*, A **28** 627)] with methyl bromide in a 15-in. vacuum at the rate of 3 lb. per 1,000 cu. ft. space, including the load, for 1½ hours at temperatures exceeding 34°F., or at atmospheric pressure for 2 hours at the same rate if the mass temperature is between 50 and 70°F. or at 1½ lb. per 1,000 cu. ft. if it exceeds 70°F. Atmospheric fumigation is not recommended at temperatures below 50°F. Small quantities of these vegetables may be sent by parcel post without fumigation when certified by an authorised inspector to be free from infestation.

Other information in this part includes supplements to plant-quarantine import regulations already noticed in Malta, Argentina and Cuba.

Barber (G. W.). **Hibernation of the Corn Earworm in southeastern Georgia.**—*Tech. Bull. U.S. Dep. Agric.* no. 791, 17 pp., 2 refs. Washington, D.C., 1941.

The following is substantially the author's summary. A study of the hibernation of *Heliothis armigera*, Hb., was made in Chatham County, Georgia, during 1930–33. The larvae were allowed to enter the soil under cages that were kept in the same positions from year to year, and the experiments covered the same periods each year, roughly representing the incidence of the different generations. Because of overlapping generations, larvae became full-grown and entered the soil to pupate continuously from the latter part of May until early October. Some of these individuals died as larvae or as pupae, but the percentages that survived ranged from 44 to 88, with an average of 75, in cages examined in the year in which the larvae entered the soil and from 30 to 80, with an average of 51, in cages examined in the following summer, after hibernation; parasitism was very low. The depth at which larvae pupated ranged

from less than one to more than ten inches. They burrowed deeper in dry soil or in soil that was well packed ; those that had developed on green pods of string beans did not go so deep as those that had developed on maize kernels ; and maize-fed larvae burrowed much deeper after mid-August than earlier in the season. The three types of emergence that were recognised were immediate, delayed within the current year and delayed until the following year. Most of the adults from larvae that entered the soil between May and mid-August emerged in 11–15 days, but a few emerged after as much as three months. Whenever larvae entered the soil, some of the resulting pupae delayed emergence and were potential hibernators. The pupae from most of the larvae that entered the soil after mid-August hibernated. Moths emerged from these pupae from 1st May to 23rd July in 1931, from 2nd April to 27th June in 1932 and from 18th April to 27th July in 1933. Hibernating individuals remained in the soil for from 190 to 333 days.

The variation in depth to which the larvae burrowed, and consequently at which pupae rested, evidently enabled the species to survive conditions unsuited to the active stages above ground, since resting pupae were continuously present in the soil and moths were continuously emerging throughout the growing season. These facts apparently help to explain the uniformity with which the active stages occur in the south-eastern United States throughout the growing season. In general, pupae lying at the greatest depths in the soil did not transform quickly and many of them hibernated, whereas those not so deep usually gave rise to adults in a short time. For four periods of the three years, the average depths of pupae that gave rise to adults promptly were 2·7–3·3 ins., whereas the average depths of pupae that showed delayed emergence or hibernated were 4·8–5·7 ins. It has been shown that field maize planted early in the season in Virginia is less injured by *H. armigera* and produces a greater yield than later-planted maize. The present studies indicate that few of the larvae maturing in early maize hibernate. It seems reasonable to conclude that if all field maize of an area were planted early and followed by crops that were not attractive food-plants, the overwintering population of *Heliothis* would be reduced and the smaller number of larvae occurring early in the following season would cause less injury to early maize than formerly.

VERRALL (A. F.). **Dissemination of Fungi that stain Logs and Lumber.**—*J. agric. Res.* **63** no. 9 pp. 549–558, 13 refs. Washington, D.C., 1941.

The results are given of investigations carried out during the last 10 years at sawmills in Louisiana and Mississippi on the dissemination of fungi that stain logs and sawn timber. The fungi are spread by means of air currents and milling machinery, which are now less important than before chemical treatments were in common use, by rain water, which, however, does not penetrate the interior of the piles, where most serious staining occurs, by the transport of infected wood, which causes " sticker stain " when stained green cross stickers are used in constructing seasoning piles, and by insects. Air-borne spores may infect log ends, untreated timber at the few mills not employing dips, and treated timber during prolonged wet periods, when chemical treatments are not particularly effective ; and dissemination during the milling process is important when no chemical treatment is applied to the timber as it leaves the mill, particularly when stained logs are being milled.

The importance of insects depends on that of the fungi carried, the habits of the insects and their abundance on green wood. Ambrosia beetles appear to be common and effective carriers, since the chemical treatment does not prevent staining in stored hardwood logs if they are abundant ; they are important in inoculating timber, since they bore deeply into both logs and freshly sawn wood of the most stain-susceptible hardwoods, where the fungus is not affected by

surface chemical treatment. Of the 176 adults of *Platypus compositus*, Say, *Xyleborus affinis*, Eichh., *Pterocyclon mali*, Fitch, and undetermined species cultured, 16 per cent. yielded important staining fungi. The only important bark-beetles encountered during the investigation were an undetermined species of *Ips* and *I.* (*Orthotomicus*) *caelatus*, Eichh. A high percentage of the adults of both species yielded *Ceratostomella ips*, which is probably carried by all individuals, and several other fungi were isolated from them and from fresh galleries of the unidentified species in unstained pine logs. The most important inoculations by bark-beetles probably occur in freshly cut pine logs, which are frequently attacked in large numbers when stored for only short periods. Both species are attracted in large numbers to fresh pine timber in seasoning piles during the flight season and were observed penetrating deeply into the piles; inoculation also occurs by means of spores left by the adults on the surface of the wood, and, if bark is present, they penetrate through it and inoculate points where the fungus is not affected by chemical treatment. When outbreaks of *Dendroctonus frontalis*, Zimm., occur in standing pines, this beetle probably disseminates *C. pini* in mill yards as well as in trees and logs; also the air may be full of spores from dead trees during active outbreaks. The only other bark-beetle observed was a species of *Pissodes*, which is sometimes found tunnelling into bark on the edges of pine timber, but no important staining fungi were isolated from the 15 adults collected. Of the powder-post beetles, *Xylobiops basilare*, Say, attacks green pecan, persimmon and ash timber, and 11 of 20 adults captured on pecan timber were found to carry important staining fungi. This species is of little importance, however, unless it commonly visits the more stain-susceptible species of wood in its journey to those in which it breeds. Some fungi were isolated from adults of Staphylinids, Tenebrionids and a Carabid, and from a Dipterous larva taken on piled timber, but little is known of the extent to which these insects migrate to unstained wood. No isolations were attempted from mites, but they are known to carry spores and may cause secondary spread of staining fungi within piles.

Of the important staining fungi, *Graphium rigidum*, *Ceratostomella pluriannulata*, *C. pilifera*, *C. ips*, *Endoconidiophora coerulescens* and *Diplodia natalensis* were found to be carried by air and insects; the first five were also transmitted by milling machinery and the last four by the transport of infected wood; *C. ips* and probably *C. pini* are disseminated chiefly by the bark-beetles with which they are specifically associated.

In the practical application of data on dissemination, it is necessary to consider not only the vectors, but also the sources of inoculum. The general use of stain-control chemicals has probably greatly reduced the amount of inoculum of staining fungi in seasoning yards. Previous observations indicated that slabs, edgings and similar green material are suited to the production of spores of staining fungi in large numbers, but old and weathered débris is not, and sanitation in and round seasoning yards should, therefore, include the restriction of accumulations of green refuse of both pine and hardwood. In hardwoods, the fruiting of staining fungi is common on the ends of logs and the ends of planks cut from stained logs, and quicker utilisation of hardwood logs and wider use of chemical treatment for the log ends are therefore desirable.

Cupples (H. L.). **Relation between Wetting Power of a Spray and its initial Retention by a Fruit Surface.**—*J. agric. Res.* **63** no. 11 pp. 681–686, 2 figs., 11 refs. Washington, D.C., 1941.

Experiments are described in which a rotating apple was sprayed with various concentrations of wetting agents dissolved in water or in a solution of sodium bicarbonate, and the retention of spray mixture at the point of run-off determined by weighing the retained aqueous solution or by titrating the sodium-bicarbonate solution with hydrochloric acid. The spreading coefficients

of the solutions on mineral oil were used as a measure of their wetting power [*cf. R.A.E.*, A **26** 321] ; plotting these against the corresponding retentions of spray mixture showed a close negative correlation between these values.

Austin (J.) & Richardson (C. H.). **Ability of the Firebrat to damage Fabrics and Paper.**—*J. N. Y. ent. Soc.* **49** no. 4 pp. 357–365, 10 refs. New York, N.Y., 1941.

The following is based on the authors' introduction and summary. Since the firebrat (*Thermobia domestica*, Pack.) is often responsible for damage to fabrics and paper attributed to the silverfish (*Lepisma saccharina*, L.), experiments, which covered the period from September 1938 to June 1939, were undertaken to determine which of the common fibres used in textiles are preferred by it under starvation conditions, to study the relative efficiency of these fibres for extending its survival, and to consider its ability to survive on a readily eaten paper. The damage by it to 25 fabrics of seven fibres (cotton, jute, linen, ramie, rayon, silk and wool) and to three papers (two low-ash filter papers and one medium typewriter bond) was investigated. Medium typewriter bond paper, regenerated cellulose, either knitted or plain weave, and linen were the materials most heavily damaged ; cotton and silk were attacked if the texture of the material was very suitable for feeding. The typewriter bond was the only one of the three papers tested that was seriously damaged. The significance of the ability of *Thermobia* to survive on these materials was tested statistically by comparing data for the survival period on the material with the survival data for the corresponding starvation control. The differences in the mean survival periods were significant for knitted regenerated cellulose and for medium typewriter bond paper.

Hayward (K. J.). **Insectos de importancia económica en la región de Concordia (Entre Ríos).** [Insects of economic Importance in the Region of Concordia in Entre Ríos.]—*Rev. Soc. ent. argent.* **11** no. 2 pp. 68–109. Buenos Aires, 1941.

Lists based on the annual reports for 1934–39 of the experiment station at Concordia are given of insects that infest economic and ornamental plants there, showing the plants they attack, the importance of the injury they cause and their natural enemies, and of the parasites bred, showing their hosts.

Lepage (H. S.). **Uma praga de diversas plantas de arborização na capital** (*Ceroplastes grandis*). [*C. grandis*, a Pest of various ornamental Trees in São Paulo City.]—*Biologico* **7** no. 12 pp. 343–346, 1 pl. São Paulo, 1941.

Ceroplastes grandis, Hemp., infests *Jacaranda* and *Platanus* in avenues and parks in the city of São Paulo, and some of the trees are so heavily attacked that they are unlikely to survive. All stages of this Coccid are described, and its distribution and food-plants in Brazil are given. The control measures recommended are pruning, scraping and 2–3 applications at weekly intervals in January or February of a spray containing 2 per cent. of an emulsion of soap, mineral oil and water (1 : 4 : 2), which kills the newly hatched Coccids.

Entomological Section.—*Rep. Dep. Sci. Agric. Barbados 1939–40* pp. 9–10. Barbados [1941].

Work on the biological control of *Diatraea saccharalis*, F., on sugar-cane in Barbados in 1939–40 included the introduction, breeding and liberation of the melanic race of *Metagonistylum minense*, Tns., and *Theresia claripalpis*, Wulp (*Paratheresia diatraeae*, Brèth.) from Brazil and experiments on crossing

the former with the Amazon race introduced from St. Lucia [*cf. R.A.E.*, A **29** 3–5]. The abnormally low rainfall of 1939–40 was unfavourable to the parasites, and though a few recoveries of *Metagonistylum* had been made by the end of March 1940, it had not established itself. Rearing of the egg parasite, *Trichogramma minutum*, Ril. [**28** 413] proceeded normally, with a record production of 342 millions for field colonisation.

Spraying of cotton with lead arsenate was carried out more generally, with a resultant reduction of defoliation by *Alabama argillacea*, Hb.; no damage by *Platyedra gossypiella*, Saund., was recorded. Sweet potato, of which a considerable additional acreage was planted as a war-time measure, was severely defoliated and infested by *Euscepes postfasciatus*, Fairm., owing to lack of spray apparatus and materials. Considerable damage to sweet potato and pigeon peas (*Cajanus cajan*) by a Jassid, probably *Empoasca fabalis*, DeLong, was observed during the year, and in many cases injury was more severe than would be accounted for by the direct effect of the feeding of the leafhopper.

Ferris (G. F.). **The Genus *Aspidiotus* (Homoptera ; Coccoidea ; Diaspididae).** —*Microentomology* **6** pt. 2 pp. 33–69, 8 figs. Stanford Univ., Calif., 1941.

The author gives a bibliography of the genus *Aspidiotus*, discusses its status and scope and reviews its history and geographical distribution. He gives a list of approximately 530 names that have been referred to it primarily or secondarily and another of the twelve species that he considers to belong to it and of their synonyms. The food-plants, distribution and characters of these are given and eight of them are figured and included in a tentative key.

Alfaro (A.). **El escarabajo de la patata (*Leptinotarsa decemlineata* Say).** [The Potato Beetle.]—*Bol. Pat. veg. Ent. agríc.* **10** pp. 39–80, 2 figs., 6 maps (1 fldg.), 5 pp. refs. Madrid, 1941 ; also as [*Publ.*] *Serv. Def. sanit. Patata.* Saragossa, 1941.

An account is given of the spread of *Leptinotarsa decemlineata*, Say, on potato in North America and Europe since its discovery on the eastern slopes of the Rocky Mountains in 1824. It was first found in Spain in the summer of 1935 [*cf. R.A.E.*, A **27** 583 ; **28** 297] and by the end of 1940 occurred over a belt of country about 120 miles wide adjoining and roughly parallel with the Pyrenees, and extending from coast to coast. The points at which it was recorded are shown on a map, and notes are given on the recognition of infestation and the cultural, mechanical, physical and chemical measures that are recommended for control [*cf.* **26** 467, etc.]. Attention is being given in Spain to the introduction of natural enemies and the production of resistant potatoes.

Benlloch (M.) & del Cañizo (J.). **Observaciones biológicas sobre la langosta común (*Dociostaurus maroccanus* Thunb.), recogidas en los años 1940 y 1941.** [Biological Observations in 1940 and 1941 on the common Locust, *D. maroccanus*.]—*Bol. Pat. veg. Ent. agríc.* **10** pp. 110–124, 4 figs., 2 refs. ; also as *Publ. Serv. Lucha contra la Langosta* no. 11. Madrid, 1941.

Apart from the permanent outbreak areas of *Dociostaurus maroccanus*, Thnb., in Spain [*cf. R.A.E.*, A **26** 698], accidental ones have been created at several aerodromes near Madrid, where considerable bands of phase *gregaria*, necessitating control measures, occurred in 1940. These measures were effective, and in 1941 the locusts were of phase *dissocians* ; contributing factors in the collapse of the outbreak may have been the abundance of the Bombyliid, *Cytherea* (*Glossista*) *infuscata*, Mg., and the high rainfall in the spring of 1941.

Hatching in 1941 occurred much later than in 1940, owing to lower spring temperatures. Studies on egg-pods have shown that their length ranges from 14·3 to 27·5 mm., and the number of eggs in a pod from 15 to 48, with 26–40 eggs occurring most frequently. Observations are described on oviposition and the development of hoppers in the field, and notes are given on the Bombyliids, *C. infuscata* and *Systoechus ctenopterus*, Mikan, and the Clerid, *Trichodes ammios*, F., which destroy the eggs.

Moreno Márquez (V.). **Las trochas contra la langosta.** [Zinc Barriers against Locusts.]—*Bol. Pat. veg. Ent. agríc.* **10** pp. 125–139, 7 figs., 2 refs.; also as *Publ. Serv. Lucha contra la Langosta* no. 12. Madrid, 1941.

Detailed instructions are given for the installation of zinc barriers against moving bands of hoppers of *Dociostaurus maroccanus*, Thnb., in Spain. Their disadvantages are the cost of the material, and the fact that they are effective only against hoppers in the later instars.

Moreno Márquez (V.). **Unas pruebas de labores en terrenos infestados con canutos de langosta.** [New Experiments in Ploughing in Ground infested with Locust Eggs.]—*Bol. Pat. veg. Ent. agríc.* **10** pp. 140–147, 3 refs.; also as *Publ. Serv. Lucha contra la Langosta* no. 13. Madrid, 1941.

Laboratory experiments on the effects of ploughing on the eggs of *Dociostaurus maroccanus*, Thnb., in Spain [*R.A.E.*, A **29** 450] were followed by field experiments. The results were not conclusive, but suggested that cultivation with a Roman or a mould-board plough, with or without subsequent harrowing, was ineffective. Ploughing in spring was useless, and the method is generally uneconomical in cases of sparse infestation.

Morales Agacino (E.). **El genero *Dociostaurus* (Fieber) en España. (Nota sistemática.)** [The Genus *Dociostaurus* in Spain. Systematic Note.]—*Bol. Pat. veg. Ent. agríc.* **10** pp. 341–360, 14 figs., 10 refs.; also as *Publ. Serv. Lucha contra la Langosta* no. 14. Madrid, 1941.

The author quotes two keys to the adults of the four species of *Dociostaurus* that occur in Spain and follows them with detailed descriptions and notes on distribution.

Moutia (A.). **Division of Entomology.**—*Rep. Dep. Agric. Mauritius 1940* pp. 14–16. Port Louis, 1941.

In 1940, the search for parasites suitable for introduction into Mauritius for the control of *Lachnosterna* (*Phytalus*) *smithi*, Arr., on sugar-cane was curtailed owing to war conditions. The distribution of parasites was carried out as in preceding years [*cf. R.A.E.*, A **29** 609], and over 4,000 examples of *Campsomeris phalerata*, Sauss., were liberated in 12 highly infested centres. No recoveries of the Tachinids released in previous years were made, and only one example of the introduced toad, *Bufo marinus*, was captured in the up-country. The planting of varieties of sugar-cane resistant to *L. smithi* [*cf.* **28** 587] and the practice of short-season planting in areas where it is abundant were encouraged.

During investigations in Madagascar from March to July, a Braconid parasite was found attacking larvae of a species of *Diatraea* very like the one occurring in Mauritius, and 245 examples were imported and liberated in infested localities in Mauritius. Of the borer parasites introduced from Ceylon [**29** 610], *Xanthopimpla stemmator*, Thnb., was relatively abundant at its original place of liberation and 1,671 individuals were collected and liberated at 38 points in

batches of 40–80, while over 175,000 laboratory-bred examples of *Trichospilus pupivora*, Ferrière, were released. This Eulophid showed an inclination to attack pupae of *Sesamia vuteria*, Stoll. *Microbracon* (*Bracon*) *albolineatus*, Cam., was not recovered, and the last individuals of the laboratory stock died in April, owing either to too much inbreeding or to breeding on host larvae of an inappropriate size and age. The first experimental liberation of laboratory reared *Trichogramma evanescens*, Westw., was made early in January 1941, in the north of the Island.

Breeding of *Dirhinus auratus*, Ashm., for liberation against *Dacus* spp. was continued, and 200 individuals were released, including a colony of 74 at Rodriguez. Spraying young bean plants with an emulsion of Diesel oil and clay containing 1–2 per cent. actual oil gave satisfactory results against *Agromyza phaseoli*, Coq. Wooden packing cases from Indo-China were found in the Custom warehouse to be heavily attacked by *Heterobostrychus aequalis*, Waterh., and *Dinoderus* sp. As these Bostrychids have not been recorded in Mauritius, all infested material was burnt.

Mamet (R.). **On a few Coccidae (Homopt.) recently described from Mauritius.**—*Proc. R. ent. Soc. Lond.* (B) **11** pt. 2 pp. 35–37, 1 fig. London, 1942.

In the course of this paper the author proposes the new name *zingiberi* for *Aspidiotus subterraneus*, Mamet [*R.A.E.*, A **28** 320], which is pre-occupied, and transfers the species to *Aspidiella*, which he regards as generically distinct from *Aspidiotus*.

Corbett (G. H.) & Pagden (H. T.). **A Review of some recent entomological Investigations and Observations.**—*Malay. agric. J.* **29** no. 9 pp. 347–375, 2 pls., 16 refs. Kuala Lumpur, 1941.

Some of the information in this survey of work on injurious insects in Malaya has already been noticed. The results of several years' investigations in which rice was sown in irrigated tanks at monthly intervals to determine whether there was a peak period for reproduction of the stem borers, *Diatraea polychrysa*, Meyr., *Chilo suppressalis*, Wlk., *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) and *Sesamia inferens*, Wlk., not entirely dependent on the abundance of the food-plant, and whether better crops could be obtained by sowing earlier than usual, showed that the yield was most consistently high from plants sown in May and June [*cf. R.A.E.*, A **24** 104] and that the largest numbers of egg-masses were present in October–January and March. Otherwise healthy rice with empty glumes was found to be heavily infested by *Haplothrips ganglbaueri*, Schmutz, in one season and by *Sogata furcifera*, Horv., in the next [*cf.* **28** 322]. The latter was feeding at the top of the stems, just below the inflorescences, and yields were obtained from inflorescences enclosed in bags but not from unprotected ones.

Promising results in the protection of stored grain from insects were obtained in laboratory tests by mixing a proprietary inert dust or precipitated chalk with it. Local storage conditions render fumigation practically impossible, but chloropicrin was effective in small air-tight stores of sacked rice. High dosages of carbon dioxide did not give complete mortality of rice pests [*cf.* **30** 339], but low concentrations inhibit insect activity and may be useful for the protection of rice in the husk. In experiments with small lots of grain infested by *Calandra oryzae*, L., *Tribolium castaneum*, Hbst., *Oryzaephilus surinamensis*, L., and a species of *Laemophloeus*, exposure to a temperature of 60°C. [140°F.] for 45 minutes killed all insects and exposure to 50°C. [122°F.] for two hours killed all adults but those of *Laemophloeus*, which were unaffected. At the temperatures prevalent in Malaya, *C. oryzae* breeds rapidly at a relative humidity of 70 per cent., but reproduction is much slower at 50 or 60 per cent. Sound

rice in the husk was not damaged by any of these insects, *Rhizopertha dominica*, F., or *Lophocateres pusillus*, Klug, but if the husk was punctured by a needle, *Calandra*, *Rhizopertha* and *Lophocateres* fed and bred in it. *Laemophloeus* caused no visible damage to hulled rice, and did not breed, but lived for a long time, on damp and broken rice ; *Tribolium* and *Oryzaephilus* fed on the germ of hand-hulled rice, but caused no measurable damage to sound rice. Macaroni was protected from *C. oryzae* and flour and packaged cereals from *T. castaneum* by storage in air-conditioned rooms at a relative humidity of 60 per cent.

Since the burial of dead trunks of the oil palm [*Elaeis guineënsis*] would probably result in an increase of termites, particularly *Coptotermes curvignathus*, Hlmgr., which causes serious damage to the standing palms by boring from the base to the crown through the trunk, they should be allowed to decay on the gound, but care should be taken to destroy all stages of the Dynastid, *Oryctes rhinoceros*, L., and of the weevil, *Rhynchophorus schach*, Ol. The latter is attracted to a palm two days after felling and can complete its life-cycle in 87 days, giving rise to conditions suitable for *Oryctes* in two months. Though the Dynastid was not found in undisturbed peat, it bred in surface layers of peat containing decaying vegetable matter. The creation of breeding places inoculated with *Metarrhizium anisopliae* [*cf.* **26** 434, etc.] is not recommended for its control, as the authors consider that the fungus becomes prevalent only when the larvae are unhealthy and that the elimination of breeding places will give control. Breeding of *Oryctes* was observed in boles and stumps of rubber trees and in sawmills, and such sites provide dangerous sources of infestation for neighbouring coconut palms. Many of the insects that attack coconut are controlled by parasites ; larvae and pupae of *Parasa lepida*, Cram., are attacked by *Apanteles parasae*, Rohw., and *Chrysis shanghaiensis*, Fr. Smith, respectively ; young larvae of *Chalcocelis albiguttata*, Snell., are killed by a bacterial wilt and heavily parasitised by *Fornicia chalcoscelidis*, Wlkn., and the pupae are killed by a fungus, *Cordyceps* sp. ; and larvae of *Hidari irava*, Moore, are attacked by insect parasites and a bacterial wilt. Though *Artona catoxantha*, Hmps., is attacked by parasites, high winds and heavy rain are the main controlling factors. It was found that after comparatively short outbreaks of insects such as *Artona*, there was considerable decrease in the yield of coconuts in the year following defoliation, but this was possibly compensated for by a marked increase in yield in the following years.

Lepidosaphes cocculi, Green, caused considerable damage to about 200 acres of clonal rubber by sucking the sap of the branches, causing leaf-fall and die-back. It was controlled by spraying with kerosene emulsion, which caused some scorching owing to imperfect emulsification. A small defoliated area of one variety showed marked recovery after lopping. *Valanga nigricornis*, Burm., causes little injury to rubber, but may defoliate the bush cover, *Tephrosia*. The eggs of this Acridid are laid in May–August and hatch in November and December ; adults are general throughout February. Tea grown in the Cameron Highlands is sometimes severely damaged by *Helopeltis cinchonae*, Mann, and *H. bradyi*, Waterh., and hand collection and the introduction of predacious Reduviids has been carried out since the middle of 1940 [*cf.* **30** 339]. *Endochus cameronicus*, Miller, and species of *Isyndus* and *Euagoras*, which had been recorded as attacking *Helopeltis* in this district, were bred and liberated in the tea area, and *E. plagiatus*, Burm., *Rhinocoris marginellus*, Thnb., *Sycanus leucomesus*, Wlk., *I. heros*, F., and *Cosmolestes picticeps*, Stål, were introduced from the lowlands ; the last three appear to have become established.

The occurrence in Malaya of a wilt of pineapples induced by *Pseudococcus brevipes*, Ckll. [*cf.* **28** 322] has been established experimentally, but the disease appears to be less destructive than in other countries, probably owing to evenly distributed rainfall with frequent heavy storms. The mealybugs concentrate

in the outside of the old leaf bases at or just below soil level and not, as in Hawaii, in the centre and on the aerial parts. Wilt was more prevalent on mineral than on peat soils. In the Cameron Highlands, cutworms, chiefly *Agrotis ypsilon*, Hfn., which damage vegetables, were controlled by broadcasting a bait composed of 1 lb. Paris green and 20 lb. bran at the rate of 130 lb. per acre four days before planting out the seedlings ; and a spray containing 0·1 per cent. nicotine applied at intervals of four days with or without a spreader, gave better control of *Plutella maculipennis*, Curt., on cabbage than derris or pyrethrum sprays.

The improved condition of the golf course in the Cameron Highlands and intensive hand collection of the adults have reduced the population of *Anomala shanica*, Arr. [which was previously identified as *A. aureola*, Hope (*cf.* **25** 794, etc.)]. In November 1935 and February 1936, respectively, *Campsomeris prismatica*, Sm., an effective parasite of *Melolontha hastata*, Arr. [previously recorded as *Hoplosternus* sp. (*cf.* **25** 794)] at Fraser's Hill, and *C. quadrifasciata*, var. *fimbriata*, Burm., *C. leefmansi*, Betr., and *C. annulata*, F., from Java, were liberated against this Rutelid, but no recoveries of the last three have been made.

The control of termites in buildings is discussed, and it is stated that arsenicals introduced into the runways are rarely if ever carried to the nest of a subterranean termite in sufficient quantities to exterminate the colony. In 1940, " ataps " (dried leaves of the nipah palm, *Nipa fruticans*), which were being used extensively as roofing material for huts, were severely damaged by larvae of the Noctuid, *Simplicia caeneusalis*, Wlk. Spraying with a proprietary fungicide was ineffective, as the material was attacked where the spray had not penetrated, but the immersion of the leaves in cresol-soap solution before use showed promise. *Camponotus irritans*, Fr. Smith, is frequently troublesome in wooden bungalows, particularly in bathrooms ; it is usually associated with decayed branches of old trees and with bamboo hedges, on which it attends the Coccid, *Antonina maritima*, Green, and the elimination of these sources assists in reducing the colonies. Bungalows have been freed of these ants within a month by brushing some of them on to a shallow tray dusted with Paris green, and allowing them to crawl over the poison and out of the tray, at least once every two days.

Insect Pests.—*Agric. Gaz. N.S.W.* **52** pt. 11 pp. 589–592, 3 figs. Sydney, 1941.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **30** 370] includes notes on the control of *Heliothis armigera*, Hb., on tomatos based on recent investigations. In areas where infestation occurs regularly, routine treatments should begin when the first blossoms begin to set and continue for 6–8 weeks. The best results are obtained by alternately spraying and dusting with lead arsenate until the plants are about waist high, after which dusting becomes difficult and involves the danger of dust flying back into the face of the operator. For early tomatos in North Coast areas, a spray of 3 lb. lead arsenate powder per 40 gals. should be applied weekly, and the crop should be dusted with lead arsenate and kaolin (1 : 1) between spraying. The whole of the plant should be covered by the spray and only the tops, the blossom and the young fruit with the dust. When the plants become too tall for dusting, spraying should be continued at least once a week, using 4 lb. lead arsenate in 40 gals. water. A similar programme of alternate spraying and dusting should be adopted for late crops in the Central Coast districts. From mid-February to the end of March, when infestation is most severe, the sprays should comprise 2 or 3 lb. lead arsenate in 40 gals. water, and the dusts a weaker mixture of lead arsenate and kaolin (1 : 2). The importance of frequent and regular treatment and of commencing operations early is emphasised.

DUMBLETON (L. J.). *Anobium magnum* (**Coleoptera, Anobiidae**) : **a new Borer.** —*N.Z.J. Sci. Tech.* **22** no. 6B pp. 294B–299B, 6 figs. Wellington, N.Z., 1941.

Descriptions are given of the adult male and larva of *Anobium magnum*, sp. n., which occasionally causes severe damage to structural timber in New Zealand, and of the characters distinguishing the larva from that of *A. punctatum*, DeG. Both larvae and adult males were taken in the dead wood of spruce, *Picea abies* (*excelsa*) in 1929, and the larvae were also found in flooring made from the wood of rimu (*Dacrydium cupressinum*) in 1940. *A. magnum* is less common than *A. punctatum*, but the damage it causes is very severe. The larval burrows are much larger than those of *A. punctatum*. In the timber examined, most of the workings were in the bottom half of the boards, which were reduced to powder with the bottom surface merely a thin lamina. The emergence holes were through the bottom and were about 0·1 inch in diameter. The pupal cell is constructed immediately below the emergence hole; it is dark brown in colour and apparently cemented or built up with some secretion of the larva. The flooring had been down for less than six years but was in a damp and ill-ventilated situation. The life-cycle probably lasts two years.

TIEMEIER (O. W.). **The Dermestid Method of cleaning Skeletons.**—*Kans. Univ. Sci. Bull.* **26** no. 10 pp. 377–383, 2 figs., 2 refs. Lawrence, Kans., 1940. [Recd. 1942.]

The Dermestids, *Attagenus piceus*, Ol., and *Dermestes maculatus*, DeG. (*vulpinus*, F.), have been used to clean skeletons and skulls in the University of Kansas Museum of Birds and Mammals for more than 20 years. The author describes the procedure, the precautions taken and the equipment of the room in which the work is done, and points out the advantages of the method.

KNIGHT (H. H.). **The Plant Bugs, or Miridae, of Illinois.**—*Bull. Ill. nat. Hist. Surv.* **22** art. 1, [5+] 234 pp., frontis., 181 figs., 4½ pp. refs. Urbana, Ill., 1941.

The main part of this bulletin comprises keys to the subfamilies, genera and species and brief descriptions of the 440 species dealt with, of which 330 have been found in Illinois and 110 in neighbouring areas, together with records of their food-plants and distribution and collection records for Illinois if available. In addition there are sections on taxonomy and biology, and on the distribution and habitat preference of Capsids that occur in restricted areas in Illinois, and one, written in co-operation with W. P. Flint, on the economic status and control of members of this family.

One of the most important is the tarnished plant bug, *Lygus oblineatus*, Say, which is the commonest Capsid in the eastern United States and has been misidentified in American literature for many years as *L. pratensis*, L., a European species. The adults hibernate from autumn to early spring and feed on newly set peaches when the petals have just fallen, causing " catfacing " ; in some years, 7–8 per cent. of the fruits in an orchard may be affected, but dusting with very fine sulphur at petal-fall has given some protection. This Capsid also feeds on the new shoots of nursery stock, causing die-back, and injures various fruits by attacking the buds. Since it is active and widespread and feeds on more than fifty economic plants, including most deciduous and small fruits, many vegetables, cotton, tobacco and lucerne, and on many weeds and grasses, no satisfactory control method has been developed. The genus *Lygus* and *Neolygus*, which the author considers distinct from it, include several other injurious species. *N. communis*, Knight, may leave its natural food-plant, dogwood (*Cornus* sp.) and breed on pear trees, where the nymphs

feed on the small fruits, causing them to grow knotty and malformed; no satisfactory method of control is known. The adults of *N. caryae*, Knight, sometimes migrate from hickory, their natural food-plant, to peach, where they puncture the young fruit, causing injury similar to that caused by *L. oblineatus*. Serious damage by this insect has been reported from New York and Ohio. The adults of *L. hesperus*, Knight, cause considerable loss of lucerne seed by puncturing the flower buds and feeding on them in several western States, and *L. elisus*, Van D., does similar damage, but is less numerous in most localities.

Halticus bracteatus, Say, is a pest of white clover and other leguminous crops in Illinois, and sometimes destroys entire crops of garden beans in Missouri and 50–60 per cent. of the lucerne crop in South Carolina and neighbouring States. *Psallus seriatus*, Reut., is a serious pest of cotton, more important in Texas, Oklahoma, Georgia and South Carolina than in Illinois, The nymphs and adults feed on the small flower buds, causing them to drop, and sometimes cause the plant to grow tall and spindly, resulting in a light set of squares; they can be controlled by the use of fine sulphur dusts. *Lygidea mendax*, Reut., which is very abundant in some eastern States, but has not yet been found in Illinois, attacks apples, and may cause excessive shedding of the fruit and malformation at harvest. The use of nicotine dusts or the addition of nicotine sulphate to the pink-bud spray controls the nymphs. *Poecilocapsus lineatus*, F., attacks many cultivated plants, such as currant, gooseberry, mint, parsnip and some other vegetables, as well as dahlia and rose. It fluctuates greatly in abundance in Illinois, and in some years control by the application of nicotine dust is justifiable. *Labopidea allii*, Knight, is not usually important on cultivated onions in Illinois, but sometimes kills Bermuda onions before they are full-grown in other States. It is common on wild onions (*Allium cernuum*) and wild garlic (*A. canadense*). *Lopidea davisi*, Knight, breeds on wild phlox, but often forms colonies on cultivated phlox and causes serious injury. It can be controlled with a nicotine or pyrethrum spray or dust. *Adelphocoris lineolatus*, Goeze, is abundant on lucerne and sweet clover (*Melilotus*) in the upper Mississippi river valley, and *A. rapidus*, Say, attacks cotton in the south. Other species from time to time reported as pests are *Paracalocoris hawleyi*, Knight, on hops, *Melanotrichus althaeae*, Hussey, on hollyhock (*Althaea rosea*) and *Miris dolabratus*, L., on timothy grass (*Phleum pratense*) and other grasses.

[**Insect Pests in New Mexico in 1939–40.**]—*Rep. New Mexico agric. Exp. Sta.* **51** (1939–40) pp. 41–55, 4 figs. State College, N.M. [1941.]

Experiments with baits for adults of the codling moth [*Cydia pomonella*, L.] were continued [*cf. R.A.E.*, A **28** 221]. When organic acids, alcohols and esters and plant extracts such as nicotine (in the form of nicotine sulphate) and pine-tar oil were compared in field and cage tests by adding them to an emulsion of glycerine and gum tragacanth in water or to the standard syrup bait (1 part cane syrup in 9 parts water) at concentrations of 2 cc. (2 gm. if solid) per 100 cc., valeric acid, nicotine sulphate and pine-tar oil appeared to be mildly attractive when used with the emulsion and showed possibilities for increasing the attractiveness of the syrup. The emulsion alone attracted no moths and is useful for comparing the inherent attractiveness of pure chenicals in the field. Water through which carbon dioxide, hydrogen or oxygen, the end products of most lines of carbohydrate fermentation, had been bubbled did not stimulate response in the olfactometer; but in field-cage tests, water treated with hydrogen or carbon dioxide consistently attracted more moths than plain water or water with oxygen, suggesting that these gases may be more than neutral carriers for the aromas of volatile acids, alcohols and esters produced in fermentations. In tests of sprays against the larvae on apple, there was practically no difference in

the degree of control, calculated as percentage sound fruit, obtained from a calyx and six cover sprays of cryolite or from split schedules in which the first three of the cryolite sprays were followed by four sprays of phenothiazine (thiodiphenylamine) or fixed nicotine. The spray concentrations were 3 lb. cryolite or phenothiazine or 4 lb. Black Leaf 155 per 100 U.S. gals., and a spreader was used in all sprays.

Statistical analysis of the results obtained at State College in 1939 in tests of sprays and dusts for the control of psyllid yellows, caused by the potato Psyllid [*Paratrioza cockerelli*, Šulc], and hopperburn, caused by the western potato leaf hopper [*Empoasca abrupta*, DeL.], on potato [*cf.* **29** 638] showed that dusts containing sulphur all gave higher yields than sprays of lime-sulphur or wettable sulphur and that a mixture of sulphur and pyrethrum dust (10 per cent. Dry Pyrocide) gave the greatest total yield and the largest amount of potatoes of the highest grade. In further tests in 1940, infestation by the Psyllid was so light at State College that practically no injury developed and there was little difference in yield between treatments, but in the Bluewater area, where a heavy infestation by the Psyllid occurred in August, the results confirmed those of 1939. *Chlorochroa sayi*, Stål, and species of *Lygus* caused injury to beets grown for seed and were controlled by applications of pyrethrum dust (dry Pyrocide No. 10) at the rate of 40–50 lb. per acre followed by flood-type irrigation, which killed the paralysed adults. These species and *Adelphocoris superbus*, Uhl., *Rhinacloa forticornis*, Reut., and *Psallus seriatus*, Reut., also damaged cotton.

Riedl (W. A.). **Sulphur Dusting for the Control of Psyllid Yellows of Potatoes.**—*Bull. Wyo. agric. Exp. Sta.* no. 245, 15 pp., 3 figs., 6 refs. Laramie, Wyo., 1941.

In order to find a more satisfactory method than spraying for the control of *Paratrioza cockerelli*, Šulc, which causes the condition known as psyllid yellows on potato and is responsible for considerable losses of crop in Wyoming, the effectiveness of sulphur dusts and sprays were compared in small-scale tests in 1939 and 1940. In 1939, all the treatments, which were applied on 17th and 29th July and 16th August, gave significant or nearly significant increases in yield over untreated plots. Sulphur dust (98 per cent. of which passed a 325-mesh screen) applied at the rate of 70 lb. per acre, resulted in yields significantly and almost significantly higher, respectively, than those from applications of 2 U.S. gals. lime-sulphur and of 5 lb. wettable sulphur and 1 U.S. gal. lime-sulphur in 80 U.S. gals. water per acre ; the difference between the two sprays was not significant. In 1940, the concentration of lime-sulphur and wettable sulphur (without lime-sulphur) were increased to 2½ U.S. gals. and 8 lb. per 80 U.S. gals. water, respectively, the rate of application of the dust was halved and the treatments were made on 25th July and 13th and 26th August. Sulphur dust gave the best control of the adults and eggs, but the lime-sulphur gave better control of the nymphs, probably because the dust was applied too lightly or too late. All treatments gave significant increases in yield over the untreated plots; lime-sulphur gave significantly and insignificantly higher yields than wettable sulphur and sulphur dust, respectively. In field trials, in which a power duster was used, sulphur dust gave insignificantly higher yields than lime-sulphur, wettable sulphur or no treatment when the Psyllid population was small and significantly higher yields when it was larger. It is pointed out that dusting is quicker than spraying and requires less labour and motive power, that the necessary equipment is cheaper, lighter and more convenient to use, that more chemicals can be mixed in dust form and that dusts are less caustic than sprays. The materials are more expensive, however, and cannot be applied in windy weather unless a hood is used.

It is concluded that sulphur dust applied at the right time [*cf. R.A.E.*, A **29** 638] at the rate of 40–50 lb. per acre should give satisfactory control of *P. cockerelli*, but that further large-scale tests are necessary to determine whether dusting with sulphur is more economical than spraying with lime-sulphur in large fields.

LAVOIPIERRE (M.). **The Acarine Parasites of South African Acridids, with special Reference to the Genus** *Podapolipus*.—*J. ent. Soc. sthn Afr.* **4** pp. 71–80, 5 figs., 5 refs. Pretoria, 1941.

A summarised account is given of the mites that infest locusts in South Africa [*cf. R.A.E.*, A **29** 177, 322], together with a list of the known Tarsonemids of the genus *Podapolipus* and descriptions of *P. grassii*, Berl., *P. locustanus*, sp. n., and *P. solitarius*, sp. n., all three of which are parasitic on Acridids in South Africa. *P. grassii*, which was taken on *Locusta migratoria migratorioides*, R. & F., and on some grasshoppers was found to produce no ill effects on its host. All stages of an undescribed Tydaeid of the genus *Proctotydaeus* were discovered on *Acanthacris* (*Cyrtacanthacris*) *ruficornis*, F., subsp. *lineata*, Stoll.

NEL (R. I.). **Varietal Interplanting in Relation to Control of the Codling Moth.**—*J. ent. Soc. sthn Afr.* **4** pp. 111–134, 9 figs., 26 refs. Pretoria, 1941.

An account is given of preliminary observations, made in Cape Province during the three fruit seasons of 1937–40, on the influence of different combinations of pear varieties on the progress of infestation by *Cydia* (*Carpocapsa*) *pomonella*, L., throughout the season, its survival from one season to another and its general abundance. In two orchards of different varietal composition, the numbers of larvae trapped in bands on well-scraped trees indicated that the time at which larvae of the first generation matured depended on the variety of pear, the peak period of production differing by as much as 2–3 weeks between some varieties. The succession in time of larval production seemed to follow the order of blossoming, the females appearing before the blossoming period of the earliest varieties and apparently choosing trees in blossom for oviposition. Differences were recorded between varieties as regards the total production of larvae and the relative production of larvae of the first and second generations. The main factors that influence varietal infestation and the production of mature larvae in orchards (of apples as well as of pears), which comprise the seasonal level of adult activity, the time and period of availability of fruit, and the varietal attractiveness for oviposition and resistance to infestation, are discussed, and the influence of various varietal types on the increase in population during the season and on the population surviving from one season to the next is analysed. In orchards restricted to late-blossoming and early-ripening varieties, it is probable that the greater part of the normal attack by the first generation will be evaded, that the overwintering population of larvae will be small and subject to heavy mortality and that the population of adults will be small in spring. Late-ripening varieties will apparently be less severely infested in orchards restricted to such varieties than in mixed orchards. The practical results of restricted varietal planting and its advantages from the standpoint of control by spraying are pointed out.

RIVNAY (E.). **The Activity of the Mediterranean Fruit Fly at cold Temperatures, with Reference to its Status during the Citrus Season in Palestine.**—*J. ent. Soc. sthn Afr.* **4** pp. 166–176, 5 figs., 2 refs. Pretoria, 1941.

The author discusses the phenology of *Citrus* fruits in Palestine and of the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] during the season in

which they occur [*cf. R.A.E.*, A **28** 270] and describes investigations carried out in 1933–40 on the effect of temperature and humidity on the activity of the fly. In the laboratory, most flies were inactive at temperatures of 10–13°C. [50–55·4°F.], there was little lively movement below 16°C. [60·8°F.] and no oviposition below this temperature or at relative humidities above 85 per cent. These results were confirmed by tests in which the flies were caged on oranges in the grove, the results of which indicated that no oviposition takes place at temperatures below 16°C. or on rainy days. Records taken in the grove showed that oviposition was insignificant in the latter part of November 1940 and that oranges containing oviposition holes may be reinfested throughout the period of oviposition in this fruit, and it is therefore considered advisable to leave them on the trees as long as the flies are active.

Smit (C. J. B.). **Forecasts of incipient Outbreaks of the Brown Locust.**—*J. ent. Soc. sthn Afr.* **4** pp. 206–221, 6 refs. Pretoria, 1941.

Earlier studies on weather conditions favouring outbreaks of *Locustana pardalina*, Wlk., in its outbreak area in South Africa, are reviewed [*cf. R.A.E.*, A **27** 93, 393]. To obtain figures on which forecasts could be based, it is assumed that all temperatures from September to April are high enough for hatching to occur, and only the effective precipitation [*cf.* **27** 93] is considered. The mean effective precipitation, the normal one (*i.e.* the mean ± standard deviation), and the mean number of months with less than 1 inch of rainfall are tabulated for each of five stations in the outbreak area, and, from the averages of these figures, a normal season (September to April) is defined as one receiving about 8 inches of rainfall, which may vary from 5 to 12, and having four dry and four wet months (months with less or more than 1 inch, respectively), a dry season as one receiving less than 5 inches and having five or more dry months, and a wet season as one receiving more than 12 inches and having less than four dry months. On this basis, the seasons from 1912–13 to 1936–37 in each of the five stations are classified as dry, normal and wet. Next, the seasons for the whole outbreak area are classified, a particular season being considered dry or wet if three out of five stations experienced dry or wet conditions, and compared with the records of *L. pardalina*, which underwent five major outbreak cycles during the same period.

Most of the swarm-free seasons just before incipient outbreaks were either dry or on the margin between dry and normal, while seasons of incipient outbreaks were normal. A comparison of population fluctuations in the outbreak centre at Doornberghoek from 1935–36 to 1940–41 with rainfall records suggests that an increase in population may occur in both dry and wet seasons, but that the former are more conducive to a rapid increase. The swarm-free seasons preceding those of incipient outbreaks are more important than the latter, for two summer seasons are sufficient to raise an initial population of 3 adults per acre to the critical density of a count of 100 hoppers over a distance 100 yards or of 100 adults over one of 440 yards, provided that three non-consecutive months in each season are wet and the other five months are dry, for under such conditions three generations will be produced in each season. Once the critical density is reached, an outbreak will eventuate in the following season if one effective rainfall is registered early in the latter and regardless of subsequent rainfall.

It is recommended to make counts of hoppers 2–3 weeks and of adults 6–7 weeks after general rains have fallen. About 20 random counts over distances of 100 yards for hoppers and 440 yards for adults, spaced at intervals of 5 miles, should be made over an area of 60 by 30 miles. The counts must be made only in clear, calm weather, and at air temperatures over 70°F. and should be repeated in each generation.

On the basis of counts carried out in the outbreak area in 1940–41, and the assumption that normal conditions will prevail in the following season, it is forecast that an outbreak will eventuate in the next season in the eastern part of the outbreak area with the appearance of the third generation, *i.e.* in March 1942. If only two generations are produced in that season, the outbreak will occur early in the season of 1942–43.

McClean (A. P. D.). **Some Leaf-curl Diseases in South Africa. I. Leaf-curl Disease of Tobacco.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 225 pp. 1–45, 12 pls., 2 figs., 21 refs. Pretoria, 1940. [Recd. 1942.]

An account is given of studies, begun in Natal in 1931, on the virus [*Ruga tabaci* of Holmes] that causes leaf-curl of tobacco in South Africa, the symptoms of which are described. The first large outbreak occurred in the Rustenburg district of the western Transvaal in 1928–29, when it was widespread both in old lands and in areas newly brought under cultivation; during 1931–33 it was prevalent in western and eastern Transvaal, and in 1935 it was severe in parts of the northern Transvaal, but not troublesome round Rustenburg. Comparatively few tobacco plants show symptoms of the disease before mid-season; stump suckers in old tobacco lands are probably one of the most important reservoirs. In the Transvaal, the disease has been observed in petunia and *Datura stramonium* and symptoms suggestive of it in spinach, tomato and cucurbits.

A preliminary attempt to transmit the disease to healthy tobacco seedlings from a naturally infected plant from the Transvaal by means of a colony of *Trialeurodes natalensis*, Corb., which occurred naturally on solanaceous plants under glass at the Natal Herbarium, was unsuccessful. Two naturally diseased plants from Rustenburg, infested with an Aleurodid that occurred on tobacco in the western Transvaal, and plants infected experimentally from these were used in all later experiments. The Aleurodid, which was identified as *T. natalensis*, though it is possible that another species was also present,* transmitted the virus from diseased to healthy tobacco and from tobacco to *D. stramonium*, tomato, currant tomato (*Lycopersicum pimpinellifolium*), *Nicotiana glutinosa*, petunia and *Nicandra physaloides*, and possibly also to *Physalis peruviana*, *Helichrysum monstrosum* and *Zinnia elegans*. The reactions of these plants to infection are described. In the first experiments, the virus produced the disease in its typical severe form, but in later ones mild and latent forms were produced: similar results were obtained in grafting experiments. These results suggest the possibility that plants with the severe disease contain a mixture of viruses that may separate or a single virus that may undergo a process of disintegration or alteration. The increasing tendency to transmit milder forms of the disease may indicate the existence of races of *T. natalensis* with the power of selective transmission or the presence of two species of Aleurodids, one of which transmits only the severe form and the other only the milder forms.

Priesner (H.) & Mahmoud Hosny. **Notes on Parasites and Predators of Coccidae and Aleurodidae in Egypt.**—*Bull. Soc. Fouad 1er Ent.* **24** pp. 58–70. Cairo, 1940. [Recd. 1942.]

This paper comprises records of 42 Hymenopterous parasites, 14 Coccinellids, and smaller numbers of Nitidulids, Lepidoptera, Thysanoptera, Neuroptera

* Storey cited McClean (*in litt.*) as authority for his statement [*R.A.E.*, A **23** 692] that leaf-curl of tobacco had been experimentally transmitted in South Africa by a species of *Bemisia*, close to or identical with *B. tabaci*, Gennadius (*gossypiperda*, Misra & Lamba), but McClean states in this paper that, so far as he is aware, *B. tabaci* has not been recorded in the Transvaal, though it may well occur there.

and Cecidomyiids attacking Coccids and Aleurodids in Egypt, showing the hosts and the plants on which they occurred, and a list of the 41 Coccids and 3 Aleurodids with the insects that attacked them.

Mohamed Taher el Sayed. **The Morphology, Anatomy and Biology of** *Araecerus fasciculatus* **DeGeer (Coleoptera : Anthribidae).**—*Bull. Soc. Fouad 1er Ent.* **24** pp. 82–126, 8 pls., 1 fig., many refs. Cairo, 1940. [Recd. 1942.]

The author gives detailed descriptions of the morphology and anatomy of all stages of *Araecerus fasciculatus*, DeG., and brief notes on the deposition and hatching of the eggs and the larval moults. At a relative humidity of 90 per cent., most larvae passed through four instars, though some of both sexes had three or five. Usually the first and third instars lasted about 5–7 days, the second was shorter and the fourth variable ; the numbers of larvae with three or five instars were too small to provide reliable data.

Hamid Seleem Soliman. **Studies in the Biology of** *Microbracon hebetor* **Say (Hymenoptera: Braconidae).**—*Bull. Soc. Fouad 1er Ent.* **24** pp. 215–247, 2 figs., 5 pp. refs. Cairo, 1940. [Recd. 1942.]

The author briefly reviews the literature on *Microbracon hebetor*, Say, which is typically associated with its Pyralid hosts, *Ephestia*, *Plodia interpunctella*, Hb., and *Galleria mellonella*, L., in such places as mills and warehouses, where comparatively dry plant and animal products are stored in large quantities, and discusses in some detail the methods of oviposition and hatching and the food of the larvae and of adults of both sexes. Parthenogenesis is common, unfertilised females normally producing males only. In one instance observed by the author and two recorded in the literature, however, females were produced by unfertilised parents ; the possibility is suggested that a thelytokous race is in the process of evolution, though it is not yet established.

Laboratory investigations on the life-history of the parasite were carried out in England ; the durations of the life-cycle and of the immature stages at different temperatures are shown in tables, and the lengths of adult life of mated and unmated males and females under different conditions are recorded. Observations in warehouses and in the laboratory on collected or bred material indicated that both mated and unmated females survive the winter, but that males and immature stages do not. Hibernation can be terminated by submitting the insects to favourable temperature conditions, and in nature, females may oviposit in winter when the temperature is over 17°C. [62·6°F.] or feed on the hosts when it is 15°C. [59°F.]. There are 5–7 generations in the year ; breeding usually begins towards the end of January or during February, and adults of the first generation appear between the third week in March and the end of May. Adults that emerge in October do not oviposit until the following spring. The female attacks larvae in the late instars, preferably the last, and does not oviposit until the host is completely paralysed. Under favourable conditions, oviposition begins 14–48 hours after emergence and continues until 1–2 days before death. It did not occur at temperatures below 15°C. or above 41°C. [105·8°F.], and at intermediate temperatures, increased in rate as the temperature rose ; 34 females bred on *E. kuehniella*, Zell., laid totals of 76–362 eggs at room temperature (17–28°C. [62·6–82·4°F.]). An average of about 40 per cent. of the eggs are sterile ; these are laid by both mated and unmated females and occur independently of age and season. The number of hosts paralysed per female varied with the temperature and with the host species ; single females, each provided with 20 larvae of *E. kuehniella*, paralysed an average of 7 at 20°C. [68°F.], 9·3 at 24°C. [75·2°F.] and 14 at 32°C. [89·6°F.] in three tests ; and others paralysed 4 and 6 larvae of *G. mellonella*, 12 and 14 of

E. kuehniella and 19 and 18 of *P. interpunctella*, in two tests, in which each was provided with 25 larvae of one of these species. In an experiment to determine the largest number of larvae a single female may paralyse, two that lived 14 and 18 days paralysed 86 and 93, respectively.

No hyperparasites were found ; a certain amount of cannibalism occurred in the larval stage, and larvae on hosts severely attacked by *Bacillus thuringiensis* usually became infected and quickly succumbed ; pupae were devoured by young larvae of *Ephestia* and *Plodia* ; and adults were attacked by larvae of *Galleria* and more rarely by those of *Ephestia* and *Plodia*.

GOODLIFFE (F. D.). **Studies on Insects bred from Barley, Wheat, Maize and Oats.**—*Bull. ent. Res.* **32** pt. 4 pp. 309–325, 2 figs., 16 refs. London, 1942.

The following is largely based on the author's summary of this detailed account of investigations carried out in 1939–41 on insects infesting cereal crops in southern England. Larvae of *Chaetocnema arida*, Foudr., were observed mining the stems of young barley shoots in 1939 ; this is believed to be the first record of injury to a cereal crop by this Halticid. Infestation of barley by *Chlorops pumilionis*, Bjerk., was heaviest in fields in which *Agriotes* was most injurious. The adults of *Chlorops* exhibited marked sexual dimorphism in colour and also in size, and the latter was correlated with a proportionate range in the size of its two parasites, *Coelinius niger*, Nees, and *Stenomalus micans*, Ol., which generally parasitised 20 and 30–40 per cent. of the summer generation, respectively. Perforations 1·3 mm. in diameter in the top of a cage allowed adults of *Stenomalus* to escape, but not those of *Chlorops* or *Coelinius* ; it is suggested that parasitism of the winter generation of *Chlorops* in the field could be increased by placing infested shoots in cages from which only *Stenomalus* could escape.

Larvae of *Lasiosina cinctipes*, Mg., were commonly associated with those of *Chlorops* in barley shoots, but 5–10 per cent. of those collected occurred alone, and in this case the shoots were not swollen at the nodes. This species was not parasitised by *Stenomalus* or *Coelinius* [*cf. R.A.E.*, A **27** 562]. Barley shoots that had already been damaged by insects were attacked by larvae of *Elachiptera cornuta*, Fall. ; these larvae and those of *Lasiosina* probably benefit from association with *Chlorops*, since the ears of shoots attacked by the latter do not emerge from the sheathing leaves and are thus kept moist. Larvae of both *Elachiptera* and *Lasiosina* were most plentiful after wet weather in July ; the puparia can be distinguished by the form of the posterior spiracles. *Meromyza saltatrix* var. *nigriventris*, Macq., occurred in small numbers in stunted barley shoots, on which it produced swellings of the nodes similar to those due to *Chlorops*. The puparia differed from those of the latter in being attached to the sheathing leaves by means of silk. From stunted barley shoots brought into the laboratory in July 1940, adults of *Oscinella frit*, L., and *Cerodonta denticornis*, Mg., emerged in August and adults of *Phytomyza* (*Pseudonapomyza*) *atra*, Mg., in the following spring, in addition to other species already mentioned. Adults of *Camarota curvinervis**, Latr., emerged in September 1939 from stunted shoots brought into the laboratory in July.

In addition to barley, larvae of *O. frit* were recorded from oats, wheat and young shoots of sweet maize. In oats, they were accompanied by larvae of *Lasiosina* and *Camarota* ; and in the maize, they were accompanied or followed by larvae of *Aphanotrigonum trilineatum*, Mg., and *Elachiptera cornuta*, which were presumably feeding on detritus produced by them. In July 1941, two adults of *Callitula pyrrhógaster*, Wlk., were reared from puparia of *O. frit* collected from oats ; this Pteromalid has apparently not hitherto been recorded from *O. frit*, and it may represent a phase of *C. bicolor*, Spin.

* This name is correctly *curviventris*, Latr., though it is spelt *curvinervis* in various works of reference.—Ed.

Larvae of a Muscid, *Hylemyia genitalis*, Schnabl, infested winter wheat in the field in May 1940, and *Tropidoscinis albipalpis*, Mg., *E. cornuta*, *M. saltatrix* var. *nigriventris*, a Chloropid tentatively determined as *Oscinella gracilior*, de Meij., and *Agromyza nigripes*, Mg., were bred in small numbers from potted plants of this crop kept in the laboratory during the summer. Larvae of *H. genitalis* and *A. ambigua*, Fall., pupated in the soil at the base of the plants, and the adults, together with one of the Braconid, *Phaenocarpa pullata*, Hal., emerged from the soil in the following spring.

Beirne (B. P.). **Notes on some Lepidopterous Pests on Fruit Trees, and their Parasites, in Ireland during 1941.**—*Econ. Proc. R. Dublin Soc.* **3** no. 9 pp. 107–118, 9 figs., 5 refs. Dublin, 1942.

Brief notes are given on the larvae of 27 species of moths that were collected on apple in an orchard in County Wicklow, Ireland, in May–July 1941 including records of parasites from a few of them. The proportions of the numbers of larvae of the commoner species (other than leaf-miners) collected on different dates are shown in a table. *Operophtera brumata*, L., which is very common all over Ireland and has several times been recorded as causing serious damage to fruit trees, outnumbered any other species. *Alsophila aescularia*, Schiff., was less common, and only one larva of *Erannis defoliaria*, Cl., was found, although it tends to be a common species in orchards in Ireland. *O. brumata* was parasitised by *Angitia* (*Dioctes*) *exareolatus*, Ratz., and a species of *Apanteles*. A few of the species found on apple are also recorded from pear, and five additional ones from bush fruits. In a final section, some anatomical details of the larvae of the Braconid parasites reared are described.

Deal (J.). **The Temperature Preferendum of certain Insects.**—*J. anim. Ecol.* **10** no. 2 pp. 323–356, 1 pl., 10 figs., 47 refs. London, 1941.

The following is based largely on the author's summary of the detailed investigations described. The apparatus finally selected was a brass trough, 4 ft. long, which had a glass cover and was connected with an ice box at one end and a hot bath at the other, giving a temperature range of 10–35°C. [50–95°F.] in a straight-line gradient and allowing a choice of about 1°C. [1·8°F.] in every 4 cm. Since the temperature of the air within the trough differed at both ends from that of the brass floor, a false floor of organdie was fixed half-way between the floor and the glass cover and the insects were placed on it. The relative humidity in the apparatus varied inversely with the temperature, but when food was included, it was kept nearly constant.

Tests were made on 23 species of insects representing 6 Orders and a variety of habitats, but including 15 that are pests of stored products. Each species was tested over a period of not less than three days, and its random distribution was determined by means of a control experiment, lasting for one day. At the cold end of the gradient, the metabolism of the insects slowed down to such an extent that many species were trapped there, thus indicating an apparent preference for low temperatures. For this reason, a movement towards the warm end was considered to be of greater significance than one towards the cold end. The preferred temperature of adults of *Tribolium confusum*, Duv., kept prior to the experiment at 27°C. [80·6°F.] was lower than that of others kept at room temperature, but the reaction of wireworms (*Agriotes* sp.) previously maintained at 5°C. [41°F.] for a fortnight did not differ from that of wireworms kept at room temperature. The preferred range of insects that were given food in the apparatus was narrower than that of insects that were not, and males of *Nematus* (*Pteronidea*) *melanaspis*, Htg., exhibited a wider range than females. In general, the preferences of the larvae tended to coincide with those of the adults of the same species. Adults of *Apanteles congestus*,

Nees, moved to a lower temperature on each successive day, and at the end of three days were alive and quite active, whereas a surplus stock of these parasites kept at room temperature were all dead at the end of 1½ days. In general, all the insects tested showed a definite temperature preference, but the preference was for a fairly wide range and not for any one point.

In a discussion of the results, the author states that it has been found in Canada that insect parasites can best be reared in large numbers when the stock is kept at the preferred temperature of the species, which is often lower than that formerly thought best for breeding purposes. He suggests that the eradication of insect pests with a definite temperature preference from warehouses and granaries where temperature can be controlled might be facilitated by maintaining a small area at the preferred temperature in order to attract large numbers that could easily be destroyed.

[Gilyarov (M. S.).] **Гиляров (М. С.). The Feeding of the Granary Mites *Tyroglyphus farinae* L. and *Tyrophagus noxius* Zachv. in the Seeds of Kok-saghuiz.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* **30** no. 9 pp. 854–856, 4 refs. Moscow, 1941 ; also in German in *C. R. Acad. Sci. URSS* **30** no. 9 pp. 859–861, 4 refs. Moscow, 1941.

In the Russian Union, seeds of *Taraxacum kok-saghyz* stored under damp conditions are apt to form lumps and to become covered with a dense growth of fungi. It has been observed, however, that this does not occur in the presence of the mites, *Tyroglyphus farinae*, DeG., and *Tyrophagus noxius*, Zkhv. To verify this, seeds were kept in test tubes stoppered with damp cotton wool and batches of 100 examples of *T. farinae* or *T. noxius* were introduced into some of the tubes. Observations were made at intervals for 20 days. The results showed that the seeds kept without mites adhered together in lumps, became covered with fungi, and showed some reduction in germinating power, while the others remained normal. The mites evidently fed on the fungi that developed on the surface of the achenes, and this was confirmed in further experiments in which seeds overgrown with mycelium and kept damp in test tubes became clean and loose 3–4 days after mites had been introduced, whereas the controls remained covered with mycelium. The mites are unable to penetrate the hard outer cover of the achene unless it is injured, and the seed is still further protected by the two inner covers. It appears, however, that the outer cover may degenerate if the seeds are stored under very unfavourable conditions so that the latter become accessible to the mites. Seeds having a moisture content of 15–16 per cent. and kept at 20°C. [68°F.] for 70 days had their germinating power reduced by over 20 per cent. when mites were present and 30 per cent. when they were not.

Infested seeds can be freed from the mites by fumigation with carbon bisulphide, chloropicrin or ethylene dichloride (dichlorethane), or by drying and treatment with naphthalene.

[Gilyarov (M. S.).] **Гиляров (М. С.). The Causes of the Increase in Abundance of Wireworms in Clover Fields. (Contribution to the entomological Valuation of Crops preceding Rubber-producing Plants.)** [*In Russian.*]—*Vestn. tekh. Kul'tur* 1940 no. 3 pp. 65–71, 18 refs. [Moscow] 1940. [Recd. 1942.]

The investigations described were carried out in 1939 in the Province of Moscow in plots under crops that had been sown to test their value in a rotation to include the rubber-producing plant, *Taraxacum kok-saghyz*. To ascertain their comparative attractiveness to adult Elaterids, counts were made in June–July, during the oviposition period, on the surface of the soil, under lumps of earth and in cracks in small sample plots. Of those found, *Agriotes*

lineatus, L., *A. obscurus*, L., and *A. sputator*, L., represented 86·5, 9·5 and 4 per cent., respectively. They were most numerous in fields of cereals; none occurred in fields of potatoes, flax, lupins, third-year clover or black fallow, and only a few in grass fallow or first- and second-year clover. Observations on the microclimate (temperature and humidity) of the plots during this period showed that it varied less from day to day in the fields of cereals than it did in the other fields, where the plants were less tall or absent. In August, pupae and young adults in the pupal cells were found in all plots, irrespective of crop, which indicated that the distribution of the beetles during the oviposition period had been due to the attractiveness of the plants to them.

Examination of soil samples showed that the larvae were most numerous under third-year clover or a crop following it. This was evidently because clover is sown with cereals, which attract the adults, and is allowed to grow alone in the two years that follow, without cultivation, which favours the development of the larvae. These have reached their maximum rate of feeding by the time the clover is ploughed in and cause serious damage to the crop that follows it [but *cf. R.A.E.*, A **29** 573]. When cereals are sown alone, however, most of the larvae die from desiccation while still young when the soil is ploughed after harvest.

[Gilyarov (M. S.).] **Гиляров (М. С.). The Localisation of the Click-beetles *Agriotes lineatus* L. and *A. obscurus* L. during the Period of Oviposition in the Fields of the Crop Rotation.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* **31** no. 7 pp. 726–728, 18 refs. Moscow, 1941; also in German in *C. R. Acad. Sci. URSS* **31** no. 7 pp. 725–728, 23 refs. Moscow, 1941.

The observations recorded in the previous abstract were continued in 1940, when the numbers of adults of *Agriotes* spp. taken in June in plots of 10 sq. m. [12 sq. yds.] were 10·5 for rye, 5 for third-year clover, 3·3 for first-year clover, 2·5 for oats mixed with vetch [*Vicia*], 0·5 for flax and 0 for lupin and fallow ground. This distribution was not due to feeding preferences, but was correlated with microclimate. Records of temperature and humidity of the air immediately above the soil surface during the hottest part of the day showed that the temperature was lowest and the relative humidity highest in plots of rye or clover. The soil in them was more shaded and the force of the wind less than in any of the other plots, in which the vegetation was lower and less dense. In plots under clover it would be possible to establish a considerably drier microclimate, and one less favourable for the Elaterids, by carrying out the first mowing at the beginning of the oviposition period.

[Gilyarov (M. S.).] **Гиляров (М. С.). Pests of the Seeds of second-year Kok-saghuiz.** [*In Russian.*]—*Vestn. tekh. Kul'tur* 1940 no. 4 pp. 62–69, 1 diagr., 2 figs., 5 refs. [Moscow] 1940. [Recd. 1942.]

In the Russian Union, the seeds of the rubber-producing plant, *Taraxacum kok-saghyz*, are chiefly obtained from second-year plants, which flower and bear fruit in spring and the first half of summer, and the yield is often considerably reduced by the attacks of insects that are associated with the local wild dandelions (*Taraxacum* spp.), which also flower in spring. The most important of these are the Phalacrid, *Olibrus bicolor*, F., and the weevil, *Ceuthorrhynchus punctiger*, Gylh.

O. bicolor apparently has only one generation a year. The overwintered adults emerge from the soil early in spring when the first wild *Taraxacum* begins to flower (March in Central Asia and the beginning of May in the Province of Moscow), and migrate to second-year *T. kok-saghyz* as soon as the flowers appear. The eggs are laid in the flowering capitula, and the larvae, of which there are usually 1–2 in a capitulum, hatch in 2–3 days and destroy the contents of the achenes. When the seeds ripen and the capitula open, larvae

that have completed development drop to the ground and pupate in the soil at a depth of about 2 ins., whereas those that are still immature migrate to other capitula. The pupal stage lasts a month, and the adults hibernate in the soil. *O. bicolor* is most injurious in Central Asia, where the loss of seed amounted to about 40 per cent. in 1939, the percentage of infested capitula being much higher. In the Provinces of Kursk and Moscow (European Russia) only 8 and 2–3 per cent., respectively, of the capitula were infested in 1938. *C. punctiger*, which closely resembles *Olibrus* in bionomics [*cf. R.A.E.*, A **27** 45] causes most damage in White Russia, where it infested 10–12 per cent. of the capitula in 1937.

[Radzievskaya (S. B.).] **Радзиевская (С. Б.). Small Tortoise Bugs [*Eurygaster*, etc.] and their Control.**—119 pp., 29 figs. Moscow, Sel'khozgiz, 1941. Price 1 *rub.* 40 *kop.*

In the introduction to this book, which is largely based on the literature, the author discusses the economic importance of the Pentatomids of the genera *Eurygaster* and *Aelia* that attack wheat in the Russian Union and elsewhere and the effect on their geographical distribution of temperature, humidity and other ecological factors. The first of the main sections includes an account of the distribution, the appearance of all stages and the bionomics of *Eurygaster integriceps*, Put., which is the principal species and is dealt with in detail, *E. maura*, L., *E. austriaca*, Schr., and *Aelia acuminata*, L. The second section comprises an account of the activity and importance of the natural enemies of these bugs ; the most important in Russia are the Scelionids, *Microphanurus semistriatus*, Nees, *M. vassilievi*, Mayr, *Telenomus sokolowi*, Mayr, and *Dissolcus rufiventris*, Mayr, which parasitise the eggs, and the Tachinids, *Phasia crassipennis*, F., and *Helomyia* (*Anantha*) *lateralis*, Mg., which parasitise the adults. Their bionomics are described, and notes are also given on the Tachinids, *Clytiomyia helluo*, F., *Gymnosoma rotundatum*, L., and *Cistogaster globosa*, F., which parasitise these or related Pentatomids in various parts of the world and might be suitable for introduction into Russia. The third section deals with methods of control, including the breeding and release of the egg parasites, the destruction of the hibernating bugs by means of fowls and the use of mobile traps, and a programme is outlined showing the time of year at which the various measures are applicable.

Morrison (F. O.). **Imported Carabid Beetle may be a potential Pest.**—*Canad. Ent.* **73** no. 12 pp. 217–218, 16 refs. Guelph, Ont., 1941.

Adults of *Harpalus* (*Pseudophonus*) *rufipes*, DeG., an introduced European Carabid, were reported to be numerous in the basement and other rooms of a house in Inverness, Nova Scotia, where they crawled into stored milk, meat and flour bins, but did no actual damage. The author briefly reviews other records of this species in Canada, where it appears to be somewhat generally distributed, particularly in sandy soils, and in Europe. In captivity, the beetles burrowed into sand during the daytime, but came up at night and fed voraciously on puffed wheat kernels. They were unaffected by food dipped in an ant bait of sodium arsenite and sugar, which they ate readily, but died within a few hours of crawling through a ridge of sodium fluoride.

Watkins (T. C.). **Clover Leafhopper** (*Aceratagallia sanguinolenta* **Prov.**).—*Bull. Cornell agric. Exp. Sta.* no. 758, 24 pp., 1 pl., 3 figs., 33 refs. Ithaca, N.Y., 1941.

Detailed results are given of investigations, which have already been noticed from a summary [*R.A.E.*, A **28** 180], on the biology and control of *Aceratagallia sanguinolenta*, Prov., a pest of clover and a vector of the potato yellow

dwarf virus [*Marmor vastans* of Holmes], in western New York. During 1935–38, natural enemies had little effect on the intensity of infestation. Parasitism by an unidentified Stylopid was seldom higher than 1 per cent., though in August 1935, rather more than 24 per cent. of the adults and large numbers of older nymphs were parasitised. Counts on three varieties of clover on three dates in the summer of 1938 showed that none was sufficiently unattractive or resistant to the Jassid to prevent the building up of a population dangerous to neighbouring potatoes. Control experiments on clover in 1937 and 1938 [*cf. loc. cit.*] indicated that the most satisfactory insecticide was a pyrethrum dust containing 0·125 per cent. pyrethrins, and that a concentration of 0·05 per cent. pyrethrins was the lowest that was likely to be effective. Owing to the lack of sufficient insects to show significant differences between treatments and the slight spread of yellow dwarf, few data were obtained on the control of the insect or the virus on potato. In 1936, all the treatments tested gave significant reductions in the population of nymphs ; there was no significant difference between Bordeaux mixture and dusts containing Lethane (butyl carbitol thiocyanate), pyrethrum and sulphur and sulphur alone, but a dust of pyrethrum and Celite gave significantly better control. In 1937, the only dusts that gave significant control were those containing pyrethrum. The indexing of sample tubers from one set of experiments showed that the materials that were most effective against the vector gave the greatest reductions in incidence of the disease.

CHAMBERLIN (T. R.). **The Wheat Jointworm in Oregon, with special Reference to its Dispersion, Injury, and Parasitization.**—*Tech. Bull. U.S. Dep. Agric.* no. 784, 47 pp., 6 figs., 18 refs. Washington, D.C., 1941.

In the Pacific North West, *Harmolita tritici*, Fitch, occurs only in two small areas in the Willamette Valley of Oregon, where it was first found in 1926. Wheat is an important crop in these areas, and investigations on this Eurytomid and its parasites and their dispersion were made in 1926–34. Studies on the enlargement of the colonies indicated that the average dispersion was a little over one mile per year. Infestation was heavy in the more northern area in 1927–32, but it decreased rapidly in 1933–34 ; a similar trend was observed in the other area, though the infestation was not so high. The greatly reduced infestations of 1933 and 1934 were the indirect result of low temperatures without a snow cover in December 1932, which killed most of the winter wheat and much clover in the stubble of the previous season. The stubble was ploughed under early in the spring and the dead wheat was replaced by spring wheat, much of which developed too late to be infested. In consequence, much of the stubble unburied when the adults emerged in the spring of 1934 was uninfested or lightly infested, and such fields of stubble as remained from wheat sown in the autumn or winter of 1932–33 were widely scattered and had infestations below normal.

Brief notes are given on the life-history of *H. tritici* [*cf. R.A.E.*, A **17** 621]. Field and laboratory observations indicated that the time of emergence is influenced more by temperature than by any other external factor ; a few adults emerged on 24th December in a room kept warm during the day, and emergence in the field is early when the spring is warm and sunny, and late when it is cold and cloudy, but high temperatures did not induce emergence unless there had been a considerable early accumulation of effective temperature, and low temperatures did not prevent it provided that there had been such an accumulation. Cage records of emergence in 1926–33 indicated that approximately 60 per cent. of the adults are females. The sexes emerge from the stubble during practically the same period, but the males tend to remain in the stubble fields, whereas the females leave them and disperse by short apparently random flights, moving through growing wheat very slowly. Oviposition

was largely confined to the second and third internode, and wheat sown in autumn or winter was preferred to spring-sown wheat, with the result that in Oregon good wheat was more frequently heavily infested than poor wheat. None of the varieties grown in the Willamette Valley seemed to be preferred or avoided by ovipositing females. The numbers of eggs in females collected from stubble in 1928 and 1929 averaged 84 and 98·2, respectively.

Infestation weakens the stems, so that lodging may occur, and reduces the number of kernels per head and, to a smaller degree, the weight of individual kernels. In five years, the average loss of total weight of the heads was 13·5, 26·5 and 44·2 per cent. from culms with 1, 2 and 3 infested joints, respectively. Detailed studies of the parasitism of *H. tritici* in one area between 1928 and 1934 indicated that if the potential rate of reproduction (calculated as 54 : 1) is reduced by parasites to a theoretical rate of 35 : 1 or lower, the population will actually decrease, owing to mortality due to other natural factors. The apparent percentage parasitism by *Eurytoma parva*, Phillips, *Ditropinotus aureoviridis*, Crwf., and certain Eupelmids in 1928–33 is shown in a table and a graph, but the predacious habits of the older larvae of *E. parva* made it impossible to measure accurately the total destruction caused by all the parasites, which was doubtless greater than that indicated. *E. parva* and *D. aureoviridis* were the most effective parasites. The former has only one generation a year ; the adults usually begin to emerge up to a fortnight after the first emergence of the host and may continue to oviposit until about mid-July. The eggs are laid in a cell of *Harmolita* or in the plant tissue outside it [*cf.* **15** 627] ; on hatching, the larvae burrow through the tissues and devour larvae or eggs of *H. tritici* or other *Eurytoma* larvae, after which they feed on the plant tissue and, on approaching maturity, frequently tunnel from one cell to another, destroying the occupants. They overwinter in the stubble in the last instar and pupate between mid-March and mid-April. *D. aureoviridis* has one complete generation and a partial second per year in the Willamette valley and overwinters as a full-fed larva. The adults emerge between the second week in June and the first in July and oviposit in cells of *Harmolita* in growing wheat. Adults of the small summer generation emerge between mid-July and the end of September and oviposit in the cells in stubble. *D. aureoviridis* also parasitises *E. parva* and individuals of its own species. Other parasites of less importance were *E. phoebus*, Gir., *Eupelmella vesicularis*, Retz., *Eupelmus allyni*, French, *Calosota metallica*, Gah., *Decatoma amsterdamensis*, Gir., and undetermined Pteromalids.

In the Willamette Valley, most of the jointworms in stubble ploughed under in autumn die long before the normal time of emergence of the adults, though in some seasons a few may survive and give rise to adults if some of the buried stubble is brought to the surface by spring cultivation. In experiments, the adults did not issue from stubble buried by hand shortly before the time of emergence, indicating that early spring ploughing of stubble is about as effective as autumn ploughing. Since wheat is often planted as a nurse crop to red clover, much stubble is left standing, and this is a constant source of infestation, which should be avoided by substituting winter barley or oats for the wheat. If infested stubble has not been ploughed under, wheat should be planted as far away as possible. If high stubble is burnt to avoid burying it, none should be left standing.

HOUSER (J. S.). **The Wheat Field Survey for 1941.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **26** no. 212 pp. 168–173, 4 figs. Wooster, Ohio, 1941.

The average infestation of wheat by *Mayetiola* (*Phytophaga*) *destructor*, Say, in Ohio increased to 12·4 per cent. in 1941 [*cf. R.A.E.*, A **30** 4], indicating the risk of a serious outbreak in 1942. Infestation is heaviest in parts of the north-western and south-western sections of the State. The safe sowing dates

are shown on a map, but it is pointed out that though wheat sown after these dates escapes autumn infestation, it is liable to spring infestation by migrants that emerge from neighbouring self-sown or early-sown wheat. Of other autumn-sown cereals, rye is almost immune and winter barley is unlikely to be damaged except in years of exceptionally heavy infestation. Infestation of wheat by *Harmolita tritici*, Fitch, was practically unchanged from the previous year [*cf. loc. cit.*], averaging 8·8 per cent. The use of the combine for harvesting favours the increase of this pest, which overwinters in the high stubble left in the field. *Trachelus tabidus*, F., continued to decrease rapidly [*cf. loc. cit.*] and other pests were of no importance.

Ingram (J. W.) & Bynum (E. K.). **The Sugarcane Borer.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1884, 17 pp., 5 figs., 4 refs. Washington, D.C., 1941.

The authors describe the bionomics of *Diatraea saccharalis*, F., in the United States, the injury it causes to sugar-cane, maize, rice and sorghums and the effect of weather and natural enemies on its abundance, and give an account of methods of reducing the losses of sugar-cane that it causes. It has four or five generations a year, the egg, larval and pupal stages lasting 4–9, 20–30 and 6–7 days, respectively, and hibernates in the larval stage from September or October until April in Louisiana, Texas and Mississippi ; in southern Florida, hibernation begins about a month later and ends a month earlier. Low temperatures or heavy rainfall during hibernation or after the overwintered larvae become active kill many of them.

Natural enemies include the egg-parasite, *Trichogramma minutum*, Ril., which is very widely distributed. The percentage of parasitised eggs is low in the first generation, but increases with each generation, and may be more than 90 in Louisiana in September and October. The liberation of large numbers of the parasite early in the year has proved of no value as a control measure [*cf. R.A.E.*, A **30** 117]. Of 13 species of parasites of *Diatraea* and related insects that have been introduced from other countries or other parts of the United States into areas in which *D. saccharalis* is present, the only ones that have been recovered in years other than those in which they were released were *Lixophaga diatraeae*, Tns., in Louisiana and Florida, where mass breeding and release of this Tachinid may be of value ; *Theresia claripalpis*, Wulp, which is fairly well established in several places in southern Florida and parasitises up to 40 per cent. of the larvae there, though it has not yet multiplied sufficiently in Louisiana to give effective control ; *Microdus* (*Bassus*) *stigmaterus*, Cress., which is well established in southern Florida and affords considerable control ; and *Metagonistylum minense*, Tns., which has recently been introduced into Louisiana [*cf.* **29** 354]. *Theresia* and *Microdus* have been spread in Florida by piling cane from colonised fields alongside fields where the parasites did not occur. Although ants attack various stages of *D. saccharalis*, they foster mealybugs and Aphids. Adults and larvae of the Telephorid, *Chauliognathus marginatus*, F., occasionally attack the larvae, and earwigs feed on both eggs and larvae and possibly give appreciable control in Florida. Birds give valuable control and should be protected, but fungi and bacteria are of doubtful importance.

In sugar-cane fields, the larvae overwinter in cane trash left after harvest, young summer-planted cane, seed cane, cane stubble and wild grasses, in descending order of abundance [*cf.* **28** 252]. In rice-growing areas, many hibernate in rice stubble. The numbers hibernating in maize are in proportion to its lateness in maturing. Burning cane trash destroys about 75 per cent. of the overwintering larvae without affecting the abundance of *Trichogramma*, which appears to overwinter by continuous breeding in the eggs of other hosts, and a more thorough collection at harvest time of pieces of millable cane in the fields, along roads and railways and near buildings is recommended. The

numbers in shoots of summer-planted cane can be reduced by destroying infested plants and the larvae in them before frosts begin or by cutting the plants at ground level in March and burning the parts cut off. Few adults reach the surface from planted seed cane, and their numbers can be further reduced by planting only lightly infested pieces or soaking them for 72 hours in water at ordinary temperatures, which kills about 69 per cent. of the larvae without affecting the cane ; soaking for 20 minutes in water at 122°F. destroys over 90 per cent. of the borers, but kills the sprouted and sometimes unsprouted eyes of the cane. Since larvae overwintering in cane stubble usually occur above ground or at the surface of the soil, their numbers would be reduced and additional sucrose would be obtained if the stalks were cut lower at harvest. If the stubble fields are flooded for three or four days after harvest, most of the larvae that would otherwise overwinter in the trash and stubble will be killed. Rice stubble should be grazed by cattle, burnt, flooded or dragged and flooded, and maize stalks should be ploughed under or burnt before winter.

From the results of tests with the varieties of sugar-cane commonly grown in Louisiana, it is recommended that the resistant variety Co.290 should be planted and C.P. 29/116 and C.P. 29/103 avoided in areas of heavy injury. It is estimated that cutting out dead hearts at the times of injury by the first and second generations destroys about 90 and less than 50 per cent. of the borers, respectively ; the canes suffer more injury from the later treatment. The work should therefore be done 3–4 times at intervals of 10–12 days, beginning in May when dead hearts resulting from first-generation larvae become numerous and when large larvae are first found in them. In tests of insecticides in 1937–40 [*cf.* **28** 254], synthetic cryolite dust consistently gave 90–95 per cent. control of the first generation in small plots when applied four times at weekly intervals at the rate of 10–12 lb. per acre per application, and a large-scale experiment in 1939 gave further indication of its value. Trapping the moths with baits, lights or piles of trash was ineffective, and the growing of trap-crops of maize is not recommended, since farmers have been unable to determine when they should be destroyed.

Wilson (J. W.). **Biological Control of *Diatraea saccharalis* in the Florida Everglades during 1940 and 1941.**—*Florida Ent.* **24** no. 3 pp. 52–57, 4 refs. Gainesville, Fla., 1941.

An account is given of investigations in 1940 and 1941 on the control by means of native and imported parasites of *Diatraea saccharalis*, F., on sugar-cane in the Everglades district of Florida.

Since the native parasite, *Trichogramma minutum*, Ril., does not become numerous until the end of the season, attempts were made to increase its effectiveness earlier in the year by means of mass liberations, using parasites imported from California during the spring and summer of 1940. They were sent in eggs of the grain moth [*Sitotroga cerealella*, Ol.] on pieces of cardboard in paper cups ; when the adults began to emerge, the cups were opened, carried down the cane row until most of the parasites had left and then attached to sugar-cane leaves. In this manner, 1,820,000 adults were liberated in five fields between 17th April and 16th August, smaller releases being made on the earlier than on the later dates. At harvest time, the percentage of joints bored was slightly higher than in the previous year in fields that received 1,500 or 11,000 parasites per acre, but it was lower in fields that received 3,200 or 4,000 parasites per acre and in those in which no liberations were made. These unpromising results are in agreement with those recorded in Louisiana [*R.A.E.*, A **25** 16 ; **30** 117].

Three colonies of the Amazon strain of *Metagonistylum minense*, Tns., reared in the laboratory in Louisiana were liberated in the Everglades in

September 1938, and colonies of the São Paulo strain, also reared in Louisiana, were released there in 1939 and 1940, but neither strain was recovered. In June 1941, 45 fertilised females of the São Paulo strain were imported from Louisiana as breeding stock. Field-collected larvae of *D. saccharalis* were inoculated with parasite larvae [**28** 651], after which each was placed in a small box containing pieces of maize stalk that were renewed two or three times at intervals of 2–4 days. When the parasite puparia were formed, they were transferred in lots of 50–75 to petri dishes lined with moistened paper towels, which were placed in emergence cages. Puparia were obtained from as many as 78·3 per cent. of these hosts, whereas only 45 per cent. of others that were kept together in pans containing chopped maize stalks yielded them. From a total of 3,535 host larvae inoculated, 1,718 adult parasites were obtained, of which 802 were females. When the parasites emerged, they were transferred to cylindrical cages 10 ins. in diameter and 14 ins. high, which were placed in a shady position out-of-doors during the morning of the first two days after emergence. Pieces of cotton soaked in sugar solution were placed on top of them to provide food. Colonies of 22–98 mated females were released in 18 fields on the third or fourth day, but when collections of larvae of *D. saccharalis* were made during September and October, the parasite was recovered from only two fields.

Since *Microdus* (*Bassus*) *stigmaterus*, Cress., which was introduced into Florida in 1932, appears to be spreading and increasing in importance as a parasite of *D. saccharalis*, attempts were made to rear it in the laboratory. No parasitism occurred when 9 females were confined for a week with 43 larvae of *D. saccharalis* in maize stalks, and when females were enclosed with 17 larvae of *D. saccharalis* in shell vials and with 33 in pieces of maize stalk in pint jars, each containing 2–5 hosts and 1–3 parasites, only one parasite larva emerged in each case, after 29 days in the former and 24 in the latter. From observations on parasitised larvae of *D. saccharalis* collected in the field, the larval stage of *M. stigmaterus* appears to last 18–29 days ; the duration of the pupal stage of 21 examples averaged 9·14 days. Collections were made in September and October 1941 in 20 localities, from 13 of which *M. stigmaterus* was obtained ; the percentage parasitism ranged from 3·4 to 41·4.

McGregor (E. A.). **A new Spider Mite from Virginia (Acarina: Tetranychidae)** —*Proc. ent. Soc. Wash.* **43** no. 9 pp. 223–225, 1 pl. Washington, D.C. 1941.

Descriptions are given of adults of both sexes of *Tetranychus schoenei*, sp. n., which was collected on apple trees in Winchester, Virginia, and also developed readily on several varieties of beans. It is closely allied to *T. atlanticus*, McG. [*R.A.E.*, A **29** 530], and the characters distinguishing the two species in each sex are given.

McCauley (W. E.) & Flint (W. P.). **Outwitting Termites in Illinois.**—*Circ. Ill. nat. Hist. Surv.* no. 37, 23 pp., 1 pl., 19 figs. Urbana, Ill., 1940. [Recd. 1942.]

The greater part of the new information contained in this revision of a circular already noticed [*R.A.E.*, A **26** 748] on the prevention and control of infestation of buildings by *Reticulitermes flavipes*, Koll., in Illinois deals with the employment of chemicals for the treatment of soil beneath and contiguous with the foundations. The choice of the chemical to use should be governed by the physical and chemical nature of the soil, the fluctuation of the water table, rainfall, exposure to sun, method of application, cost, the site of the infestation in relation to the building and the toxicity of the chemical to plants, animals and man. Organic compounds are usually dissolved in oil and inorganic

compounds in water before application. The latter may be preferable inside the foundation of the building as they are odourless, while the former are more lasting outside as they are more resistant to leaching.

EDWARDS (W. H.). **Report of the Jamaica Government Information Bureau for the Building Industry.**—42 pp., 17 pls. Kingston, 1941.

In a section dealing with technical investigations (pp. 22–23), it is stated that inspection of buildings infested by termites in Kingston and St. Andrew showed that the infestations were due to defective methods of construction, to negligence of the builder in leaving wooden forms over concrete foundations, etc., to the use of susceptible materials, or to negligence on the part of the occupier in erecting trellises or other structures or growing creepers or other plants in such a manner that they provided access to the building from the ground. The termites that cause most destruction in urban areas were found to be *Heterotermes* (*Leucotermes*) *convexinotatus*, Snyder, *Coptotermes javanicus*, Kemner, and *Kalotermes* (*Cryptotermes*) *brevis*, Wlk.; the ratio of their incidence was 64 : 12 : 14, but it is believed that if the buildings had been inspected in series, whether or not the occupants had found them infested, the figure for *K. brevis* would have been much higher.

CHERIAN (M. C.) & ANANTANARAYANAN (K. P.). *Cirphis albistigma* **H.—a Pest of Grasses in South India.**—*J. Bombay nat. Hist. Soc.* **42** no. 3 pp. 611–616, 9 refs. Bombay, 1941.

Descriptions are given of all stages of *Cirphis albistigma*, Moore, which sporadically damages rice in South India and is a serious pest of fodder grasses in hilly regions, where it is usually found during October–December; in 1937, there was also an outbreak in May. Its bionomics were studied in 1937 and 1938 at Coimbatore and on the pastures of the Hosur cattle farm, which covers an area of about 1,600 acres at an altitude of about 3,000 ft. It caused serious damage on the farm in these two years and had been a pest there in every year from 1928 to 1931. Large numbers of larvae, all apparently of about the same age, appear in several detached meadows in different parts of the area almost simultaneously, cut the tender side-shoots of the grass close to the ground or strip the leaves from the stems, and migrate in all directions, unimpeded by roads or other obstructions. The population subsides to insignificant numbers in about a fortnight, but the mass feeding results in a great reduction in the yield of hay. The adults begin to emerge in the field at dusk; they rest on dry grasses near the place of emergence during the day. Males and females lived 3–10 and 4–14 days, respectively. Females laid 110–597 eggs, usually about 5–6 days after emergence, generally in rows or small masses inside the leaf sheaths. On hatching, the larvae migrate to tender leaves, and when full-grown, they burrow into the soil and pupate in earthen cells. The egg, larval and pupal stages lasted 4–5, 19–28 and 8–11 days, respectively; development from egg to adult required 27–43 days, and was slightly accelerated if the larvae had ample food.

The larvae and pupae are apparently unable to survive unfavourable seasons; it is possible that the Noctuid breeds throughout the year, selecting different localities for each brood. Severe outbreaks usually followed heavy flooding rains after a long period of drought. Natural enemies included crows, ants and the Tachinids, *Actia monticola*, Mall., *Cuphocera* (*Cyphocera*) *varia*, F., and *Sturmia inconspicuoides*, Baranov, which parasitised the larvae but were not common. A number of control methods were attempted, but without success. The migration of the larvae from plot to plot can be prevented, while if the outbreak occurs towards the end of the year, early harvesting of the hay minimises both the loss and larval migration.

PAPERS NOTICED BY TITLE ONLY.

PERKINS (J. F.). **A Synopsis of the British Pimplini, with Notes on the Synonymy of the European Species (Hymenoptera Ichneumonidae).**—*Trans. R. ent. Soc. Lond.* **91** pt. 12 pp. 637–659, 52 figs., 20 refs. London, 1941.

RUSSELL (L. M.). **A Classification of the Scale Insect Genus** *Asterolecanium* [including 83 new species].—*Misc. Publ. U.S. Dep. Agric.* no. 424, 322 pp., 9 pls., 84 figs., 100 refs. Washington, D.C., 1941.

EVANS (J. W.). **Underground Grass-grubs** [biology and control of *Oncopera* spp. in Tasmania].—*Tasm. J. Agric.* **12** no. 4 pp. 128–130, 3 figs., 1 ref. Hobart, 1941. [For a fuller account see *R.A.E.*, A **30** 316.]

HOFFMANN (C. H.). **Annotated List of Elm Insects in the United States.**—*Misc. Publ. U.S. Dep. Agric.* no. 466, 20 pp. Washington, D.C., 1942.

SEMANS (F. M.). **Protozoan Parasites of the Orthoptera, with special Reference to those of Ohio. III. Protozoan Parasites in Relation to the Host and to Host Ecology.**—*Ohio J. Sci.* **41** no. 6 pp. 457–464, 8 refs. Columbus, Ohio, 1941. [*Cf. R.A.E.*, A **28** 40.]

ADAMSON (A. M.). **Laboratory Technique for the Study of living Termites.**—*Ecology* **22** no. 4 pp. 411–414, 14 refs. Brooklyn, N.Y., 1941.

SELLKE (K.). **Ueber im Sommer 1938 im Kartoffelkäfer-Feldlaboratorium Ahun (Frankreich) durchgeführte Versuche zur Prüfung von Hybriden auf Kartoffelkäfer-Widerstandsfähigkeit.** [On Experiments in the Summer of 1938 at the Potato-beetle Field Laboratory at Ahun, France, to test the Resistance to *Leptinotarsa decemlineata*, Say, of Hybrids (between potato and wild species of *Solanum*).]—*Arb. biol. Reichsanst.* **23** pt. 1 pp. 1–20, 16 figs., 5 refs. Berlin, 1940. [Recd. 1942.] [For briefer account see *R.A.E.*, A **28** 449.]

[VASIL'EV (I. V.).] **Васильев (И. В.). The Pea Bruchid** (*Bruchus pisorum* **L.). Compilation from the Literature** [on its bionomics and control]. [*In Russian.*]—*Bull. Plant Prot.* 1941 no. 1 pp. 27–35. Leningrad, 1941.

[GILYAROV (M. S.).] **Гиляров (М. С.). Methods of quantitative Estimation of the Soil Fauna** [a review of the literature]. [*In Russian.*]—*Pedology* 1941 no. 4 pp. 48–77, 14 figs., 77 refs. Moscow, 1941. (With a Summary in German.)

[ZAKHVATKIN (A. A.).] **Захватнин (А. А.). Faune de l'URSS. Arachnoidea Vol. VI, no. 1. Acariens Tyroglyphoides.** [*In Russian.*]—*Inst. zool. Acad. Sci. URSS*, N.S. no. 28, xii+475 pp., 705 figs. Moscow, 1941. Price 31 *rub.* 50 *kop.* [With translations in French of keys, including descriptions of new genera and species.]

ROBINSON (R. H.). **Sprays, their Preparation and Use.**—*Bull. Ore. agric. Exp. Sta.* no. 393, 34 pp. Corvallis, Ore., 1941. [Revision of previous bulletin (*cf. R.A.E.*, A **18** 355; **24** 343).]

BENLLOCH (M.). **Nuevas fórmulas de cebos envenenados.** [New Formulae for Poison Baits (against locusts and grasshoppers).]—*Agricultura* **9** no. 93 repr. 4 pp. [Madrid] 1940; also as *Publ. Serv. Lucha contra la Langosta* no. 15. Madrid, 1942. [*Cf. R.A.E.*, A **26** 608, 698; **27** 67; **29** 461.]

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